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**EDUCATIONAL OUTCOMES IN SOUTH
AFRICA: A PRODUCTION FUNCTION
APPROACH**

by

**Morne OOSTHUIZEN
and
Haroon BHORAT**

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(DPRU)**

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AVANT-PROPOS

Le Secrétariat d'Appui Institutionnel à la Recherche Économique en Afrique (SISERA) a pour mission de faciliter l'émergence de centres d'excellence en recherche économique en Afrique subsaharienne et de les aider à jouer un rôle effectif dans le processus d'élaboration des politiques économiques. Un des objectifs du Secrétariat est d'aider les centres à disséminer les résultats de leurs travaux de recherche.

Les Cahiers du SISERA ont donc été créés pour permettre une meilleure diffusion des travaux de recherche des Institutions partenaires du Secrétariat. La présente édition des Cahiers du SISERA est consacrée à diffusion des résultats des études conduites par six Institutions partenaires du SISERA dans le cadre du programme de formation et de recherche en économie dénommé « Stratégies et analyses pour le développement et l'accès à la croissance (SAGA) » mis en place par l'USAID et administré par SISERA. L'objet de ce programme est d'accroître les capacités africaines à produire une recherche de haut niveau qui réponde aux préoccupations politiques, sur des aspects essentiels touchant le développement économique et l'accès à la croissance en Afrique subsaharienne.

Dans le cadre de ce programme, le SISERA a organisé une mise en compétition de projets de recherche, destinée à financer des propositions soumises par des centres africains de recherches économiques. Six propositions ont été financées et les études ont été conduites sur une période d'environ deux ans, de novembre 2003 en mars 2006. Les six Institutions partenaires dont les propositions ont été retenues sont, "African Institute of Applied Economics (AIAE)" du Nigeria, le Centre d'Études et de Recherche en Économie et en Gestion (CEREG) de l'université Yaoundé II au Cameroun, le Centre de Recherches Économiques Appliquées (CREA) de l'université Cheikh Anta Diop du Sénégal, le Centre Ivoirien de Recherche Économique et Social (CIRES) de l'université de Cocody en Côte d'Ivoire, "Development Policy Research Unit (DPRU) de l'université du Cape en Afrique du Sud, et le "Namibian Economic Policy Research Unit (NEPRU), Windhoek, Namibie. Les études ont été réalisées pendant la période novembre 2003 en mars 2006.

FORWORD

The mission of the Secretariat for Institutional Support for Economic Research in Africa (SISERA) is to facilitate the emergence of centers of excellence in economic research in sub-Saharan Africa, and to help them play an effective role in the economic policymaking process. One of the objectives of the Secretariat is to help the centers disseminate the findings of their research works.

The SISERA Working Papers Series was designed to provide an outlet for the research output of the Secretariat's Partner Institutions. This edition of the Working Papers is devoted to the dissemination of the results of studies conducted within the framework of the training and research program "Strategies and Analyses for Growth and Access (SAGA)" set up and funded by USAID and administered by SISERA. The overall goal of SAGA is to increase African capacity to produce high quality, policy-oriented research on key issues affecting economic growth and access in sub-Saharan Africa.

In relation with this program, SISERA has organized a research competition program to support research projects carried out by African economic research institutes. Six propositions were selected for funding and the related studies were implemented over about two years from November 2003 to March 2006. The six successful research proposals were submitted by the African Institute of Applied Economics (AIAE) in Nigeria, "Centre d'Études et de Recherche en Économie et en Gestion (CEREG)", University of Yaoundé II, Cameroon, "Centre de Recherches Économiques Appliquées (CREA), Université Cheikh Anta Diop, Senegal, "Centre Ivoirien de Recherche Économique et Social (CIRES)", University of Cocody, Côte d'Ivoire, Development Policy Research Unit (DPRU), University of Cape Town, South Africa, and the Namibian Economic Policy Research Unit (NEPRU), Windhoek, Namibia.

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1. INTRODUCTION

The education system plays a key role in economic development and prosperity in any country since it is the primary channel through which employable skills and knowledge are transferred to new generations of potential workers. Consequently, policies affecting the way in which educational institutions fulfil this function can have significant long-term socioeconomic results. This is also true of the degree to which educational institutions themselves are able to successfully and efficiently harness the resources at their disposal.

In South Africa, skilled workers are in short supply. This is evidenced by the large difference between the unemployment rates of degreed individuals and that of the population as a whole: only 4.5 percent of degreed South Africans were unemployed in 2004 according to the expanded definition, compared to the overall rate of 41.0 percent (Oosthuizen 2006, *forthcoming*). However, to increase the number of graduates, the supply of matriculants with matriculation exemption needs to be increased too. For this reason, amongst others, the release of the Senior Certificate Examination (commonly referred to as matric) pass rates is eagerly anticipated by matric candidates, parents, teachers, principals, and government officials and politicians. Inevitably, the quality of both individual schools and the education system as a whole are generally judged by the proportion of candidates that pass the Senior Certificate Examinations. The public debate tends to centre on ways of improving pass rates, with the underlying assumption being that there is a way to affect pass rates by changing the mix of educational 'inputs'. The academic debate too has tried to establish whether or not there are links between the quantity and quality of educational inputs, including family, household or community characteristics, and the outputs generated by the school in some form or other.

The discriminatory policies of the apartheid government prior to 1994 did not overlook the education system. Within South Africa, education administration was racially segmented, while the 'independent' homelands and self-governing territories were technically responsible for education within their borders. This administrative segmentation, combined with racially biased fiscal policy determined by the National Party government, resulted in large race-based disparities in per pupil (or per learner) funding across schools. The inequalities in education spending were the largest of social spending inequalities, due to the immense costs required to attain fiscal parity at the level enjoyed by White learners and resistance amongst Whites to reductions in spending (Van der Berg 2001: 405). Over time, these differences in funding resulted in a highly skewed distribution of assets and facilities, biased in favour of previously White schools. These differences also allow for an interesting analysis of the relationship between inputs and performance.

This report is the second of three reports in a project that aims to test, in the South African context, the links between inputs into the educational process and educational outputs, proxied in our case by the school's overall pass rate in the 2000 Senior Certificate Examinations. This report is essentially descriptive in nature, providing a thorough descriptive analysis of the dataset constructed from the School Register of Needs Survey of 2000, the Matric Results dataset of 2000 and the 2001 national Population Census. The third report, *Determinants of Grade 12 Pass Rates in the post-Apartheid South African Schooling System*, attempts to relate inputs and the output of school-level matric pass rates within a production function framework.

The report consists of five more sections. The following section provides a brief description of the dataset used in this and the third report. Section 3 provides an overview of

school performances in the 2000 matric examinations. In section 4, school performances are investigated according to various school-level characteristics, firstly institutional characteristics and secondly infrastructural and resource characteristics. This is followed by an analysis of school performances with respect to characteristics of local communities, which proxy for the household or family characteristics that are not available in the data. Finally, section 6 concludes.

2. THE DATA

The dataset used for the purposes of writing this report is constructed from three datasets, two of which are Department of Education (DOE) datasets. The constituent datasets are the School Register of Needs Survey of 2000, the Matric Results of 2000 and Statistics South Africa's Small Area Layer dataset of the 2001 Census. The two DOE datasets were merged together and schools were then plotted using their latitude and longitude coordinates. This mapping was then overlaid on the Small Area Layer dataset, which allowed schools to be matched to the small areas in which they are located².

The constructed dataset generally yields a very good match to aggregate official statistics of the 2000 Senior Certificate Examinations. Table 1 presents a comparison of official statistics on the 2000 results with those generated from the constructed dataset. According to the DOE, 489 941 candidates wrote the matric exams in 2000, of whom 57.9 percent passed. The constructed dataset estimates that there were 502 570 candidates in 2000, of whom 55.7 percent passed. The constructed dataset, therefore, appears to overestimate the number of candidates in 2000, while underestimating the pass rate. In terms of the actual number of passes, however, the match is extremely close. DOE statistics reveal that 277 206 candidates passed the examinations, compared to the 279 832 passes as estimated by the constructed dataset, which is an overestimate of under one percent.

Table 1: Representivity of Constructed Dataset

	<i>Constructed Dataset</i>				<i>Official Statistics, 2000</i>		
	<i>Passed</i>	<i>Failed</i>	<i>Wrote</i>	<i>Pass Rate (Percent)</i>	<i>Passed</i>	<i>Wrote</i>	<i>Pass Rate (Percent)</i>
WC	29 673	7 040	36 713	80.8	31 049	37 818	80.6
EC	36 640	41 007	77 647	47.2	28 825	74 563	49.8
NC	4 757	2 071	6 828	69.7	5 571	7 054	71.2
FS	15 611	14 645	30 256	51.6	15 703	29 477	52.7
KZ	54 432	45 426	99 858	54.5	58 620	96 423	57.2
NW	22 899	17 227	40 126	57.1	22 963	40 098	58.3
GA	43 375	23 422	66 797	64.9	47 368	68 202	67.5
MP	19 844	19 089	38 933	51.0	18 136	41 115	53.2
LP	48 246	48 465	96 711	49.9	48 971	95 191	51.4
Unlocatable	4 357	4 344	8 701	50.1	n/a	n/a	n/a
<i>Total</i>	<i>279 832</i>	<i>222 738</i>	<i>502 570</i>	<i>55.7</i>	<i>277 206</i>	<i>489 941</i>	<i>57.9</i>

Source: Department of Education (2003a: 28), SRN 2000, MR 2000 and Census 2001.

On the provincial level, matches are not always exact. Despite this, the match remains good and, in terms of the number of schools, there are 5 610 in the constructed dataset compared with the DOE's estimate of 5 651 (Department of Education 2003a: 24). It appears that there may be issues surrounding the schools' coordinates that may have led to a less successful match provincially, despite the aggregate figures being very similar. Firstly, some examination centres could not be matched to schools. These and schools that did not have coordinates could therefore not be matched to small areas in the census dataset. These schools and centres, however, account for only 8 701 candidates, or 1.7 percent of all candidates in the constructed dataset. Secondly, there may be slight inaccuracies in the geographical coordinates of schools. This may result in the misallocation of schools into incorrect small areas and, therefore, possibly into incorrect provinces. Provincial designations

² A detailed description and documentation of the merging process is to be found in the first report of this project, *Technical Report on Datasets*.

from the SAL dataset were used to ensure consistency with the small area data and consequently inter-provincial mismatches may result. However, since relatively little of the analysis that follows is provincially-based, the slight mismatch is unlikely to result in any significant distortion of the results.

Where observations in a dataset are equally important, compiling aggregate statistics is straightforward. However, in situations where observations are of varying importance within the group, the process becomes somewhat more complicated. The basic strategy to deal with observations of differing importance within the group is to weight the data, while data can be left unweighted where observations are deemed of equal weight. Weighting the data is beneficial in that the importance of observations within the whole can be accounted for when compiling aggregate statistics. One important variable that can be used as a weight in this report is the size of the schools as proxied for by the number of learners. Using this kind of a weight means that aggregate statistics are per learner statistics, allowing for a description of the data on an 'average learner' basis.

The choice, however, was made to leave the data unweighted. This is because of the fact that the school is the lowest level at which data is captured in the dataset. The performance variable is the *school's* matric pass rate, not the individual learner's aggregate or their pass/fail status. This study revolves around schools as the centre of education production and, therefore, the focus is on schools and 'average schools', rather than on individual learners.

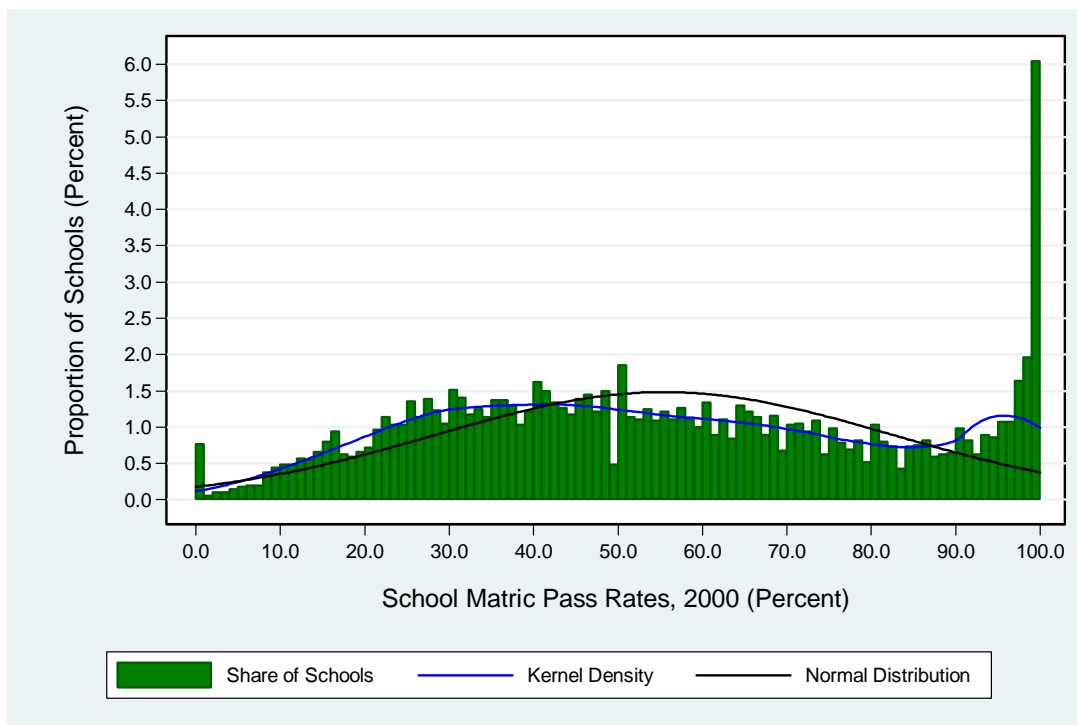
As a descriptive report, the analysis that follows tends to take cuts across matric results based on one variable at a time. For example, in section 4.1a, schools' apartheid-era education authorities are used as the basis of comparison, while later various resources are investigated. This report, therefore, does not separate out the differing effects of the numerous variables investigated on school performance. Therefore, it is important to note in the rest of this report that, in each instance, school performance is investigated in the context of a single chosen variable and that this does not take into account the effects of other variables on school performance. Further, where correlations between performance and specific variables are established, there is little, if anything, that can be said in terms of causality.

3. SCHOOL PERFORMANCE IN 2000

The constructed dataset contains the 2000 Senior Certificate Examination pass rates, School Register of Needs data of 2000 and valid geographical coordinate data linking the schools to the 2001 Census for 5 610 schools across the country. The main purpose of this section is to provide an overview of the distribution of these results across schools, both nationally and provincially.

A histogram showing the overall distribution of schools' results obtained during the 2000 Senior Certificate Examinations is presented in Figure 1 below. The black curve indicates a normal distribution, while the blue line represents the kernel density function for the distribution. Each bar represents one percentage point on the scale between a zero percent overall pass rate to a 100 percent overall pass rate. Firstly, it is evident that school performances cover the entire possible range, with pass rates varying from zero percent all the way to 100 percent. Secondly, the kernel density function indicates a bottom-heaviness in the distribution as well as a hump right at the top end of the distribution. The latter is as a result of the very high proportion of schools that attained pass rates in excess of 99 percent, represented by the final bar on the right of the histogram. In fact, the mode of the distribution is this final bar. A total of 266 schools in the dataset obtained 100 percent pass rates, equivalent to 4.7 percent of the sample, while the proportion of schools attaining pass rates above 99 percent was 6.1 percent.

Figure 1: Distribution of School Matric Pass Rates, 2000



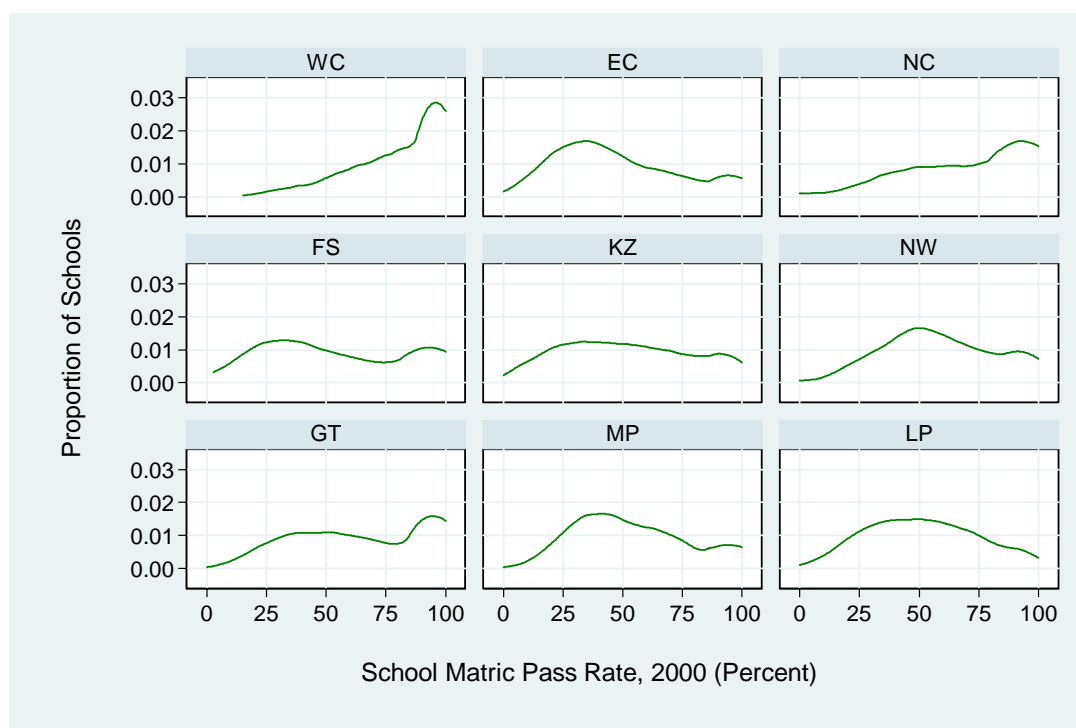
Source: SRN 2000, MR 2000 and Census 2001.

At the other end of the distribution is a clumping of schools with pass rates of less than one percent. A total of 44 schools recorded zero percent pass rates, representing 0.8 percent of all schools. The majority of these schools were relatively small – 32 had fewer

than 20 candidates in the 2000 examinations. Small schools accounted for a relatively small proportion of schools with 100 percent pass rates, though. Only 50 schools that attained 100 percent pass rates reported fewer than 20 candidates in the 2000 examinations, equivalent to 18.8 percent of schools with perfect pass rates. Thus, at a national level, school level matric pass rates are not normally distributed.

As was seen in Table 1 above, at a provincial level, there was substantial variation in the pass rates in 2000, with the Western Cape recording the top pass rate of 80.6 percent, and the Eastern Cape recording the poorest pass rate of 49.8 percent. This means that provincial pass rates ranged within a band of more than 30 percentage points. These average figures mask intra-provincial differences and, in an effort to describe these, the provincial distributions of school-level results are presented in Figure 2.

Figure 2: Distribution of School Pass Rates by Province, 2000



Source: SRN 2000, MR 2000 and Census 2001.

The distributions vary rather substantially across provinces. One province that stands out is the Western Cape, which has relatively few schools attaining low pass rates, while a large proportion of schools in the province achieved very high pass rates. As a result, the kernel density function is upward-sloping in the Western Cape for all, but the very highest pass rates. A similar, though less pronounced pattern is observed for the Northern Cape, the province with the second highest overall pass rate in 2000. Other provinces exhibit roughly bimodal distributions, with a relatively high proportion of schools recording low pass rates and a relatively high proportion recording high pass rates. This is most pronounced in Gauteng and the Free State, although most of the other provinces also have ‘bumps’ in the upper end of the distribution to varying degrees. The closest approximations of a normal distribution are found in Limpopo and the North-West.

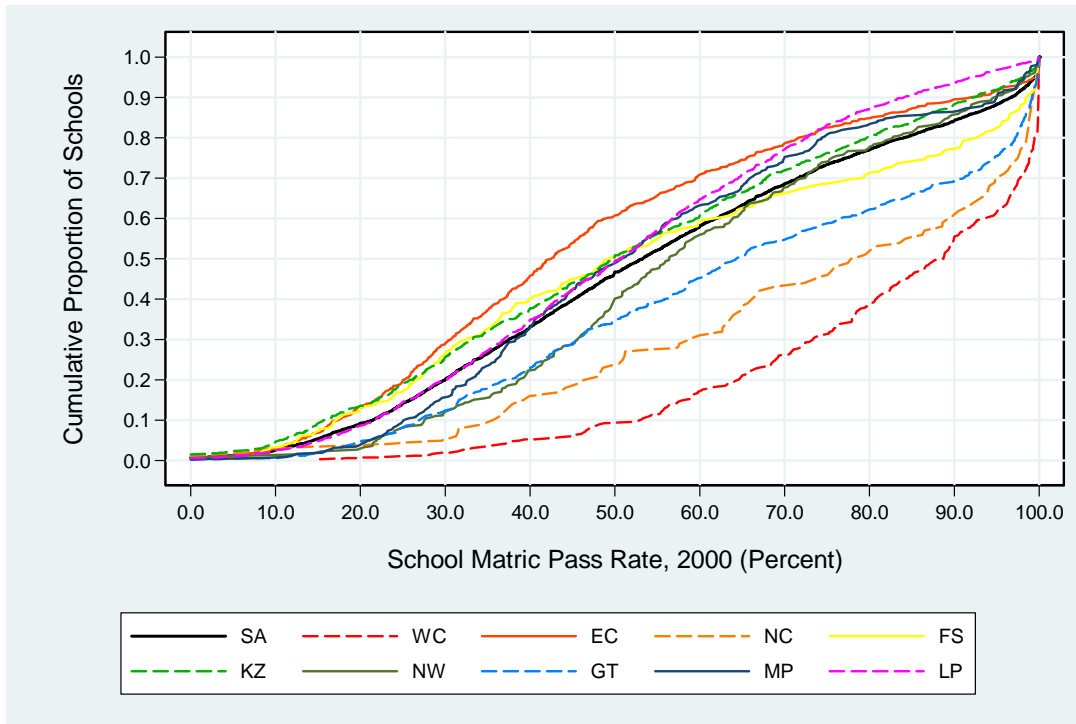
One factor that may play an important role in creating some of the differences in the provincial distributions is school dropouts. If one considers that it is unlikely that students

that opt out of the schooling system prior to Grade 12 are randomly selected from the school-going population, it is clear that dropouts may impact on the distribution of results. Specifically, if the not unreasonable assumption is made that weaker students are more likely to drop out of school prior to completing matric than better students, provinces where dropouts are most common are likely to have the distribution of their results biased upwards.

Unfortunately, accurate dropout data is difficult to find, although it is clear that dropouts constitute a large proportion of a matric-aged cohort. Van der Berg (2005) estimates that, in 2003, of the matric-aged cohort comprising 984 800 individuals, 544 404 (or over 55 percent) had already dropped out of school. Furthermore, dropouts are not randomly distributed geographically. Oosthuizen and Naidoo (2005: 32) estimate from the Labour Force Survey of September 2003 that the school attendance rate amongst 16 to 18 year olds was 83.1 percent, ranging from a low 71.8 percent in the Northern Cape and 74.6 percent in the Western Cape to 89.9 percent in Limpopo and 87.3 percent in Mpumalanga. Clearly, though, there are a multitude of different processes occurring that would need to be separated out before any definitive statement can be made, such as the fact the poorer provinces are more likely to be sending provinces in terms of migration and, since school leavers are likely to begin seeking employment and may migrate in search of work, sending provinces' attendance rates are likely to be biased upwards and those of receiving provinces downwards. Nevertheless, despite the two sets of figures being incomparable, they do serve as warning when interpreting inter-provincial differences as presented in Figure 2. In particular, the two provinces that appear to be performing relatively well, namely the Western Cape and Northern Cape, are also the two provinces with the lowest school attendance rates. This means that the superior performances of Western and Northern Cape schools is, in some part, due to higher numbers of individuals that have left school prior to completing matric.

The differing distributions of school level results translate to differing cumulative density functions at the provincial level. Figure 3 presents the cumulative density functions for the nine provinces and the country as a whole, with the cumulative proportion of schools on the vertical axis and the pass rate on the horizontal axis. The thicker black line represents the national performance, relating specific pass rates to the proportion of schools that attained those rates or lower. For example, 20 percent of schools in South Africa attained pass rates of around 30 percent or lower, while just under 70 percent of schools attained pass rates below 70 percent. In an extreme case where all schools attained a 100 percent pass rate, the cumulative density function would follow the horizontal axis from zero to just before 100 percent, rising almost vertically to the point marked by a 100 percent pass rate and a cumulative proportion of 1.0 (or 100 percent) (basically a backward L-shape). At the other extreme where all schools had a zero percent pass rate, the function would follow the vertical axis from zero to just before 1.0, from which it would move almost horizontally to a 100 percent pass rate and a cumulative proportion of 1.0. Between these two extremes, therefore, it is clear that the lower the cumulative density function (the more closely it resembles the first case, backward L-shape), the better the performance, and *vice versa*.

Figure 3: Cumulative Density Functions of Pass Rate by Province, 2000



Source: SRN 2000, MR 2000 and Census 2001.

The figure illustrates clearly the differing performances of the nine provinces. Three provinces perform at most, if not all, points better than the national average, namely the Western Cape, the Northern Cape and Gauteng. At any chosen pass rate, the proportion of schools in these three provinces with the same or weaker performances was lower than was the case nationally. For example, 9.2 percent of Western Cape schools, 23.0 percent of Northern Cape schools and 35.0 percent of Gauteng schools attained pass rates of 50 percent or lower, compared to 46.5 percent of schools nationally. The fact that these three provinces' cumulative density functions lie below the national density function is related to the generally upward-sloping kernel density functions presented earlier in Figure 2.

Interestingly, only two provinces appear to perform consistently more poorly than is the case nationally, namely the Eastern Cape and KwaZulu-Natal. For these provinces, the cumulative density functions lie at most, if not all points, above the national line, indicating that a higher proportion of schools in these provinces attained a given pass rate or lower. In the remaining provinces, the lines cross the national line at some or other point. For example, a greater proportion of Free State schools attain pass rates of up to 60 percent than is the case nationally, while from just over 60 percent, the proportion of Free State schools is lower than the national proportion. This is because, even though relatively more schools in the Free State perform very poorly (with pass rates of, say, 40 percent or lower) than is the case nationally, relatively more schools perform very well (with pass rates of, say 80 percent or more).

Comparisons of provincial performances at given school pass rates are, though, relatively cumbersome. An alternative way of comparison combines schools into groups according to their performance. Any number of groups can be formed, although too many groups may hamper the analysis. This report relies heavily on this form of comparison, using deciles which divide the distribution into ten equally sized groups each containing ten percent

of schools. Decile one is the poorest performing decile, containing the worst performing ten percent of schools, while decile ten is the best performing decile, containing the best performing ten percent of schools. Table 2 presents descriptive statistics for the ten deciles, which each contain an average of 561 schools.

Table 2: School Performance Deciles, 2000

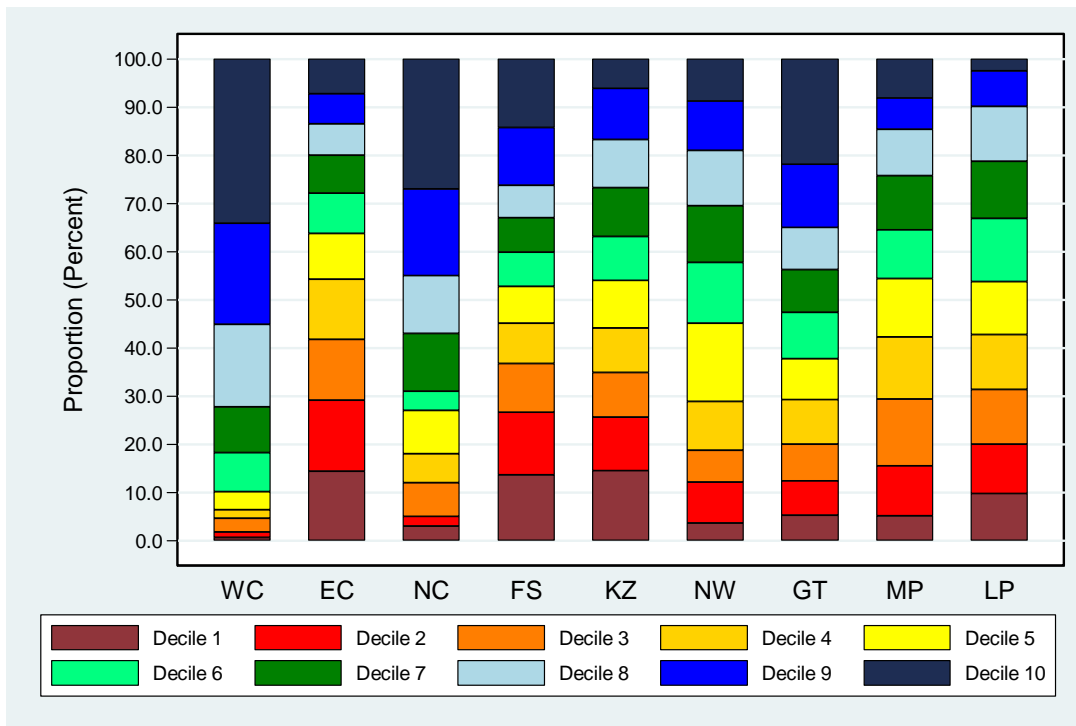
	<i>Mean</i>	<i>Median</i>	<i>Minimum</i>	<i>Maximum</i>	<i>Range</i>	<i>Observations</i>
Decile 1	13.2	14.5	0.0	21.4	21.4	563
Decile 2	25.8	25.9	21.5	30.0	8.5	559
Decile 3	33.8	33.7	30.0	37.5	7.5	569
Decile 4	41.5	41.5	37.6	45.2	7.6	554
Decile 5	49.0	48.9	45.2	53.3	8.0	560
Decile 6	57.4	57.4	53.3	61.9	8.7	561
Decile 7	66.6	66.7	62.0	71.6	9.6	562
Decile 8	77.4	77.3	71.6	84.2	12.6	565
Decile 9	90.9	91.0	84.3	96.7	12.4	558
Decile 10	99.1	99.5	96.7	100.0	3.3	559
<i>Total</i>	<i>55.5</i>	<i>53.3</i>	<i>0.0</i>	<i>100.0</i>	<i>100.0</i>	<i>5 610</i>

Source: SRN 2000, MR 2000 and Census 2001.

Overall, the mean school level pass rate is 55.5 percent, although this is of course different from the overall pass rate. The median is 53.3 percent, indicating that one-half of all schools attained pass rates above 53.3 percent and that more than one-half of schools attained pass rates of 50 percent and over. As is evident from the table, the deciles are not evenly spaced across 'performance space', i.e. the deciles do not cover the same range, with the size of individual deciles' ranges corresponding to the cumulative density function presented in Figure 3. Decile one, covering all schools attaining pass rates between zero and 21.4 percent, is the decile with the widest range. Deciles two through seven have narrower ranges at between seven and ten percentage points, indicating a greater density of schools at these pass rates. Interestingly, deciles eight and nine are significantly wider, at around 12.5 percentage points, with the narrowest decile being decile ten. Ten percent of schools attained pass rates between 96.7 percent and 100 percent, a range of just 3.3 percentage points.

The school performance deciles are derived on the national level, meaning that schools in all nine provinces can be found in each decile. Nationally, of course, ten percent of schools are in decile one and every other decile, although provincially this is not the case. The dominance of certain deciles within certain provinces and *vice versa* can provide further detail on the relative performances on an inter-provincial level. Figure 4 presents the proportion of schools within each province that are classified within each of the ten performance deciles. The identity of the best performing provinces as revealed in the previous figures, namely the Western Cape, the Northern Cape and Gauteng, is again confirmed. In the Western Cape, more than one-third of schools are to be found in decile ten (i.e. the top performing ten percent of schools). In the Northern Cape the proportion is 27.0 percent and in Gauteng it is 21.9 percent. In contrast, only 2.5 percent and 6.1 percent respectively of Limpopo and KZN schools are decile ten schools. Considering deciles eight, nine and ten, which account for 30 percent of schools nationally, more than 70 percent of Western Cape schools and 57.0 percent of Northern Cape schools are accounted for, compared to just 20.0 percent of Eastern Cape school and 21.3 percent of Limpopo schools.

Figure 4: Distribution of National Performance Deciles by Province, 2000



Source: SRN 2000, MR 2000 and Census 2001.

At the bottom end of the distribution, the provinces with the greatest proportion of decile one schools are KZN (14.6 percent), the Eastern Cape (14.4 percent) and the Free State (13.6 percent). In contrast, this is true of fewer than five percent of schools in the Western Cape (0.6 percent), Northern Cape (3.0 percent) and the North-West (3.6 percent). The bottom three deciles in total account for 41.7 percent of schools in the Eastern Cape, 36.7 percent in the Free State and 35.0 percent in KZN, compared to just 4.6 percent in the Western Cape, 12.0 percent in the Northern Cape and under 20 percent in the North-West and Gauteng.

This section, therefore, has revealed that school performances range across all possible pass rates, from zero percent to 100 percent. However, this distribution is skewed towards the lower end and does not resemble a normal distribution. Nevertheless, due to the unusually large proportion of schools attaining pass rates close to 100 percent, more than one-half of all schools attain pass rates in excess of 50 percent. There are also marked differences between the performances of schools in different provinces, although these are in part due to differing rates of attrition in the schooling system. These differences may also relate to the different apartheid histories of the various provinces and the mix of previously advantaged and disadvantaged schools within their borders, an issue that is investigated in the following section.

4. SCHOOL PERFORMANCE AND SCHOOL CHARACTERISTICS

The underlying assumption of the broader study of which this report forms part is that it is possible to relate individual schools' performances, as measured by the school pass rates in the 2000 Senior Certificate Examinations, to specific characteristics of the schools and the areas in which they are located. The School Register of Needs Survey of 2000 contains a large number of variables that describe schools, with much of the focus on physical infrastructure and resources, while the 2001 Census is able to provide information on the areas in which individual schools are located. This section aims to relate school performances to school-specific characteristics, while section 5 investigates the community-specific characteristics of schools. School characteristics are classified into two groups, namely institutional characteristics and infrastructural and resource characteristics.

4.1 INSTITUTIONAL CHARACTERISTICS

The institutional characteristics of a school are defined to encompass variables that describe the type of school, its functioning and its history. Examples of institutional characteristics include such variables as the size of the school, whether the school is a public or independent school, and the previous apartheid-era designation of the school. Another example, but one for which we have no data in this dataset, is the effectiveness, however proxied, of schools' governing bodies.

a. Schools' Apartheid-Era Department of Education

Under apartheid, education was a key arena in which the races were separated and in which Whites were privileged. As mentioned above, responsibility for the education of each of the race groups was split. Non-homeland African schools were the responsibility of the Department of Education and Training (DET), Coloured schools were administered by the House of Representatives (HOR), Asian schools by the House of Delegates (HOD) and White schools by the House of Assembly (HOA), the HOR, HOD and HOA being the three Houses in the tricameral parliament of the late apartheid era. The individual homelands and self-governing territories (SGTs) within South Africa also administered the schools within their boundaries. As a result, each school was administered by one of 14 Departments of Education³.

As a result of apartheid policies and the resultant racial and geographical separation of education administration, schools in the various departments were differently resourced, and this difference has left a long-lasting impact that has persisted post-1994. This is particularly true given the fact that, during apartheid, schools were accumulating assets at different rates based on their classification. In the post-apartheid era, schools receive their funding from provincial governments, who allocate funds from the block grants from national government. In the 2002/2003 financial year, approximately 41 percent of the R121 billion transferred to the provinces (or R49.6 billion) was spent on education (Department of Education 2003b: 18). This was equivalent to an average of R 4 489 per potential school learner aged six to 17 years. However, due to greater leeway in some provincial budgets and different age profiles across

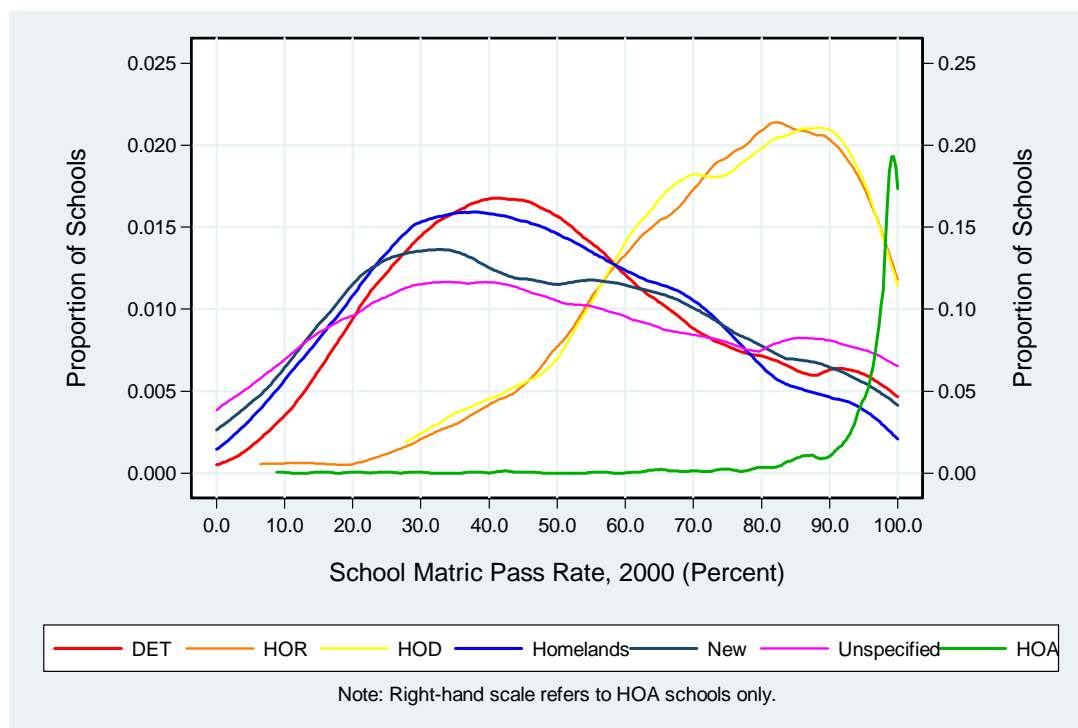
³ Specifically, the 14 Departments were the Department of Education and Training (DET), the Department of Education and Culture: House of Representatives (HOR), the Department of Education and Culture: House of Delegates (HOD), the Department of Education and Culture: House of Assembly (HOA); the four Homeland Education Departments of Bophuthatswana, Ciskei, Transkei, and Venda; and the six Departments of Education of the self-governing territories of Gazankulu, KaNgwane, KwaNdebele, KwaZulu, Lebowa and QwaQwa.

provinces, provinces did not all spend R4 489 per learner, nor did they all allocate 41 percent of their budgets to education. Thus, the provincial governments of Gauteng, the Free State and Northern Cape spent more than R5 000 per potential school learner, while those of KwaZulu-Natal, the Eastern Cape and Limpopo spent under R4 500 per potential school learner (Department of Education 2003b: 19). Non-personnel recurrent expenditure is progressively distributed, with higher expenditures per learner amongst poorer schools.

Figure 5 presents the distribution of school matric pass rates according to schools' previous apartheid-era education department. Schools that existed in 1994 have been classified as DET, HOR, HOD, HOA, or Homelands (which includes both homeland and SGT schools). Schools established post-1994 and consequently have no apartheid designations are referred to as New schools. The kernel density plots show clearly that there are three main groups of schools with rather unique patterns of pass rate distribution.

The first group consists of former DET, Homeland and New schools. The distribution of pass rates tends to be skewed to the lower end of the distribution, peaking around or below 40 percent. DET schools also exhibit the hump at the top end of the distribution, although to a far lesser degree than observed in Figure 1. The second group of schools is that of the former HOD and HOR, i.e. Coloured and Asian, schools. The distribution of pass rates of these schools differs markedly to that of the first group of schools. In the case of HOD and HOR schools, the distribution is skewed to the right, indicating that proportionally more schools attain higher pass rates compared to former DET, Homeland and New schools. The distribution peaks at pass rates of between 80 percent and 90 percent, but declines steeply at higher pass rates. Nevertheless, the proportion of HOD and HOR schools attaining 100 percent pass rates is more than double the proportion of former DET, Homeland and New schools.

Figure 5: Distribution of School Matric Pass Rates by Previous Education Department, 2000

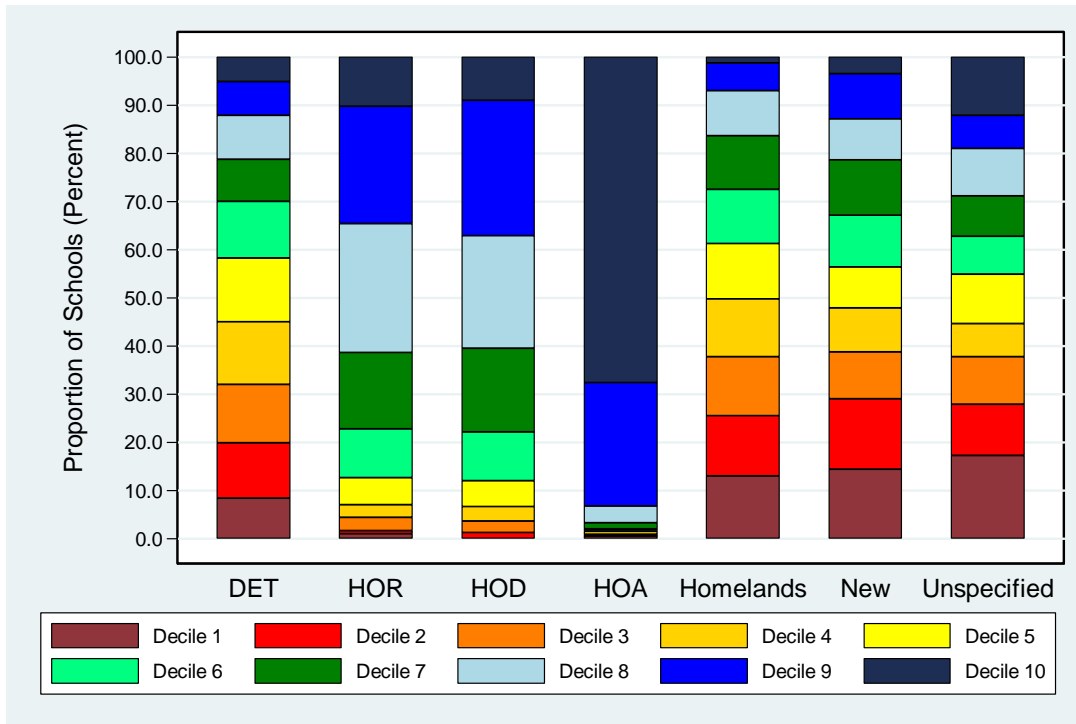


Source: SRN 2000, MR 2000 and Census 2001.

The third and final group of schools consists of former White schools. In fact, the distribution of pass rates amongst these schools is so different from the other distributions that it needs to be plotted on a separate, significantly larger vertical axis. For example, where the peak in the kernel density function is at about 0.015 for Homeland schools and around 0.021 for Asian schools, it peaks at over 0.19 for White schools, close to ten times higher than the Asian peak. The privileged position enjoyed by White schools under apartheid remains clearly discernible in the distribution of school performances. Almost no former White schools attained pass rates of below 80 percent in 2000 (only 27 out of 565 schools, equivalent to 4.8 percent). In fact, only 67 former White schools achieved pass rates below 90 percent. Consequently, 75.9 percent of former White schools with 2000 matric results attained pass rates above 95 percent and these schools accounted for over 64 percent of all schools nationally that attained perfect pass rates in 2000, compared to their 10.1 percent share of all schools with matric results in 2000.

This pattern is confirmed in Figure 6, which presents the distribution of the national performance deciles across the previous department designations. The good performance of former White schools is immediately evident, with over two-thirds (67.6 percent) of these schools in decile ten, and a further one-quarter (25.7 percent) in decile nine. Former Coloured and Asian schools exhibit nearly identical distributions, with around ten percent of schools in decile ten, but over 60 percent of schools in the top three deciles. In contrast, former DET and Homeland schools, as well as New schools, perform relatively poorly. Interestingly, it is New schools that are most likely to be in the poorest performing decile. More than 14 percent of New schools are in decile one, compared to 13.0 percent of Homeland schools and 8.4 percent of DET schools. The situation is accentuated even further if one considers the bottom two deciles, which account for 29.0 percent of New schools, 25.5 percent of Homeland schools and 19.9 percent of DET schools. In terms of the upper three deciles, performances are very similar with 21.4 percent of New schools and 21.3 percent of DET schools in deciles eight through ten, compared to a slightly lower proportion (16.4 percent) of Homeland schools.

Figure 6: Distribution of National Performance Deciles by Previous Department, 2000



Source: SRN 2000, MR 2000 and Census 2001.

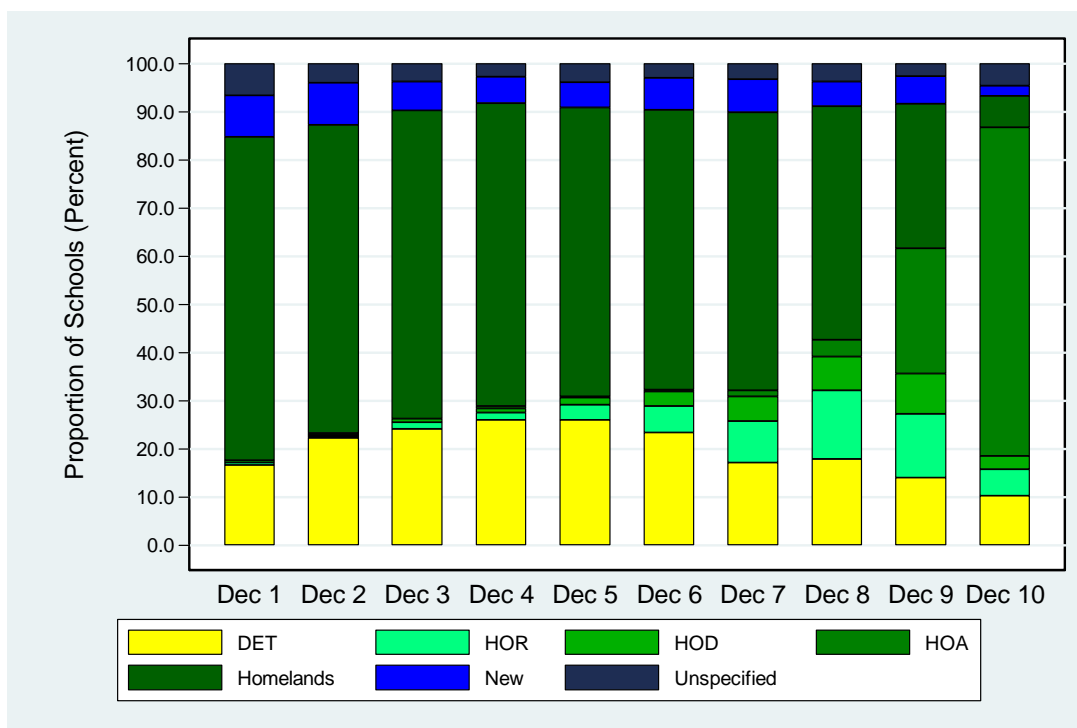
The very poor performances amongst certain New schools is very worrying phenomenon. Schools built since 1994 do not have the apartheid legacies of underfunding and under-resourcing and, on the surface, one would expect these schools to perform at least as well as similar existing schools. The poor performances of these schools, though, points to a wide variety of issues that deserve further investigation. Are New schools in fact under-resourced, either in terms of physical infrastructure, or in terms of learning materials, teacher numbers or teacher quality? Is the inferior performance of New schools perhaps related to the characteristics of the communities in which they are being built? In other words, is it because the poorest areas are often the last to receive services and schools (and were most neglected during apartheid) that New schools are faring relatively poorly? Why do some New schools perform similarly to former DET schools, such that the proportions of schools in the top four deciles are similar, while relatively more New schools perform particularly poorly and are located in the very bottom deciles? Finally, why do homeland schools continue to lag behind in terms of top performances?

The above figure seems to paint a relatively negative picture of persisting race-based performance inequalities within the education system. This view is difficult to dispute and is only marginally ameliorated from an equity perspective by the fact that previous department designations are no longer perfectly correlated with race. Nevertheless, it is important to acknowledge the fact that there are schools across all apartheid-era departments that do perform well, a fact that is obscured by the proportions presented in Figure 6.

Figure 7 takes the same data as Figure 6, presenting it in a slightly different format to confirm this assertion. In this figure, the previous departments of schools comprising the various deciles are considered. Because the deciles are equally sized, the sizes of the segments of each bar are comparable. Former Homeland schools constitute the largest group of schools both overall (51.9 percent of schools) and within each decile save decile ten. In

fact, this group accounts for more than 50 percent of schools in all except the top three deciles and in decile eight accounts for 48.6 percent of schools. Former HOA schools dominate strongly in the top decile, accounting for 68.3 percent of schools, compared to their overall share of just 10.1 percent. Interestingly, in decile nine, which covers pass rates between 84.3 percent and 96.7 percent, ex-homeland schools outnumber HOA schools by a 7 to 6 ratio, while former DET and HOR schools each accounted for more than one-eighth of decile nine schools. In this decile, the mean pass rates of former homeland and DET schools compare relatively well with that of HOA schools (90.6 percent and 89.7 percent vs. 92.7 percent). Thus, despite their underrepresentation in the upper deciles, a considerable number of schools that were marginalised and under-resourced prior to 1994 have been able to compete with the best HOA schools, a remarkable achievement and one from which valuable lessons may be gleaned.

Figure 7: Previous Department Distribution of Schools, by Performance Decile, 2000



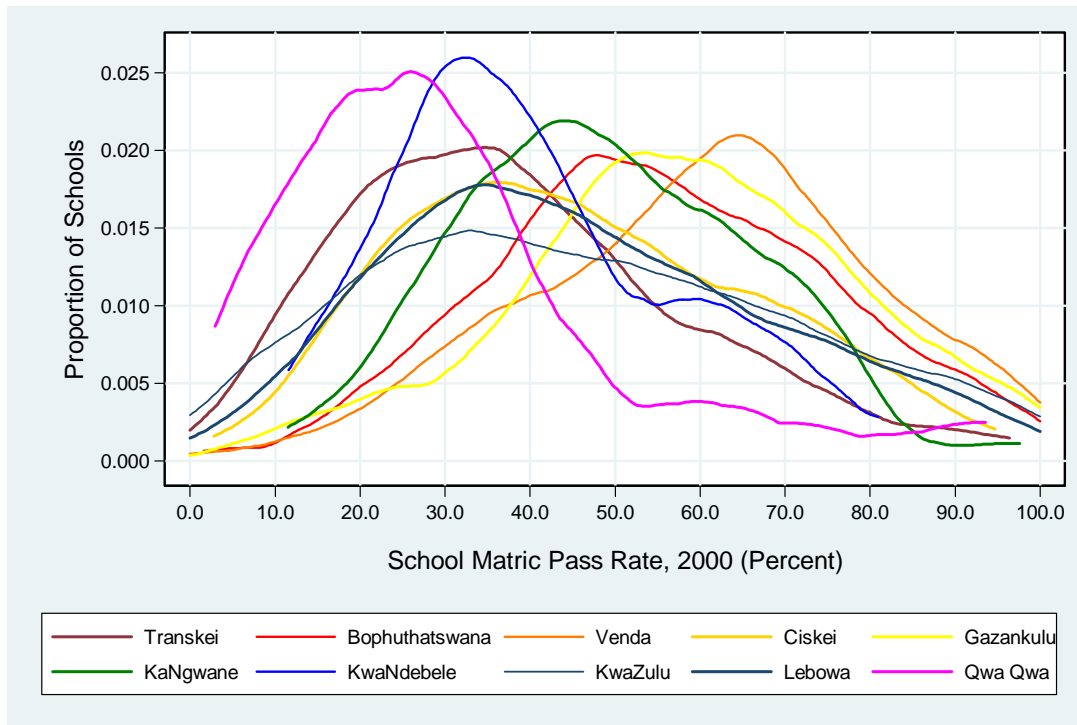
Source: SRN 2000, MR 2000 and Census 2001.

There are also clear differences in the performance of former homeland and self-governing territory schools across the former education departments. In other words, there are some former homeland and SGT schools that perform substantially better overall than others. Figure 8 below presents kernel density functions of school performance across the four former homelands (the TBVC states, namely Transkei, Bophuthatswana, Venda and Ciskei) and the six SGTs (namely Gazankulu, KaNgwane, KwaNdebele, KwaZulu, Lebowa and Qwa Qwa). Although the figure is rather cluttered, it is better able to graphically represent the distributional differences than Figure 9 is.

The figure clearly illustrates the differences between schools' performances in 2000 based on their previous education department. The distribution of performances of schools from certain departments, for example those from Qwa Qwa and KwaNdebele, are skewed towards the bottom end of the distribution. This is the case for numerous other regions, including Transkei, Ciskei, Lebowa and KwaZulu. On the other hand, the performances of

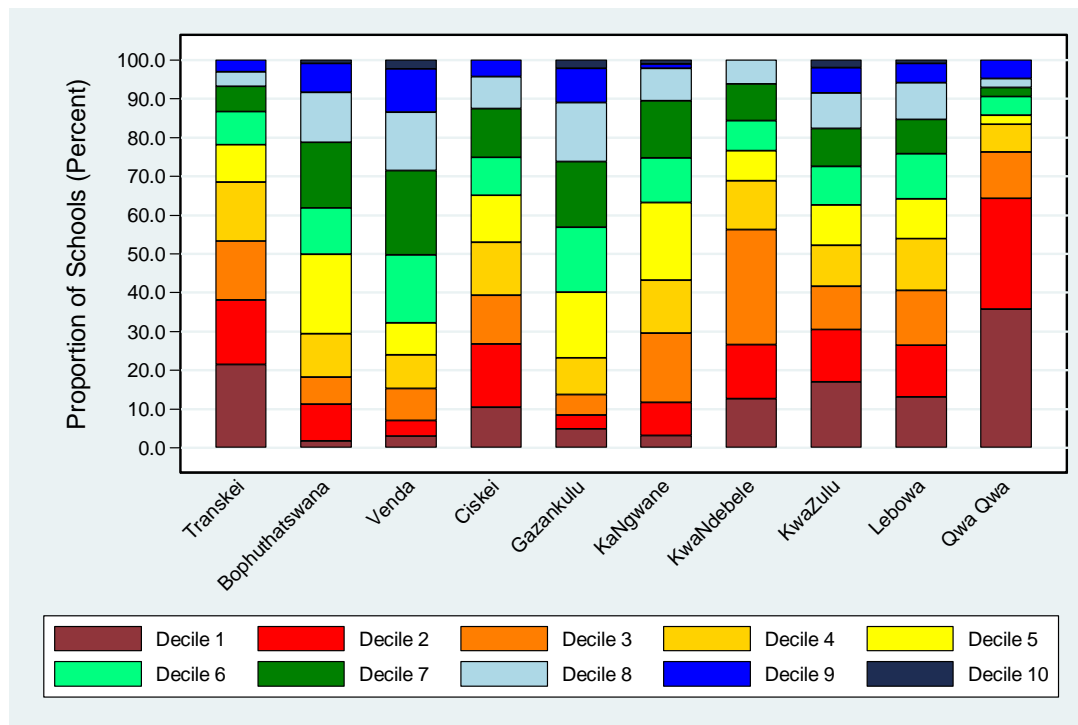
schools from the former departments of Gazankulu and Bophuthatswana are close to normally distributed. One interesting exception is the distribution of results of previously Venda schools, which is skewed towards the upper end of the distribution, peaking at close to 65 percent.

Figure 8: Distribution of School Matric Pass Rates by Previous Homeland and Self-Governing Territory Education Department, 2000



Source: SRN 2000, MR 2000 and Census 2001.

Figure 9: Distribution of National Performance Deciles by Previous Homeland and Self-Governing Territory Education Department, 2000



Source: SRN 2000, MR 2000 and Census 2001.

The differences illustrated by the kernel density functions in Figure 8 are contextualised in Figure 9 above, which illustrates the distribution of the national performance deciles across the ten former education departments. Qwa Qwa stands out most clearly with 35.7 percent of schools located in the bottom decile, a further 28.6 percent in decile two and 11.9 percent in decile three. Thus, fewer than one-quarter (23.8 percent) of former Qwa Qwa schools attained pass rates in excess of 37.5 percent (decile four or higher). Similarly, former Transkei schools perform poorly relative to other former homeland and SGT schools. More than one-fifth (21.4 percent) of these schools were located in decile one in 2000, 16.7 percent in decile two and 15.2 percent in deciles three and four, meaning that only 46.8 percent were located in deciles four through ten. KwaNdebele schools, although less likely to be located in the bottom two deciles compared to Transkei schools, were more often located in decile three, such that on 43.8 percent were in deciles four through ten.

The picture amongst former Venda, Gazankulu and Bophuthatswana schools is more positive. Almost three in ten (28.7 percent) former Venda schools attained pass rates in excess of 71.6 percent, placing them in the top three deciles. This was also true of 26.3 percent of former Gazankulu schools and 21.3 percent of former Bophuthatswana schools. In fact, former Venda schools perform, overall, considerably better than other former homeland and SGT schools. Fewer than one-third (32.2 percent) of former Venda schools are located in the bottom 50 percent of schools nationally, with only 2.9 percent located in the poorest performing ten percent of schools.

What is clear from this section is the fact that a school's history matters for its performance. Former non-White schools were systematically disadvantaged during the apartheid years, depriving them of resources, facilities and highly qualified teachers. In general, therefore, the data shows that former White (HOA) schools tend to perform

substantially better than all other schools. Former DET and Homeland schools, in particular, tend to perform worse than former Coloured and Asian schools. However, there are differences within the group of former DET and Homeland schools, with those schools that fell under the auspices of the Venda, Gazankulu and Bophuthatswana education authorities tending to perform better than schools in other homeland and SGT areas. These differing performances again point to the fact that merely because a school is an ex-homeland school does not automatically mean that the school delivers poor performances in the matric examinations. They may also be linked to differences in the level, mix and efficiency of spending on education in the various homelands and SGTs.

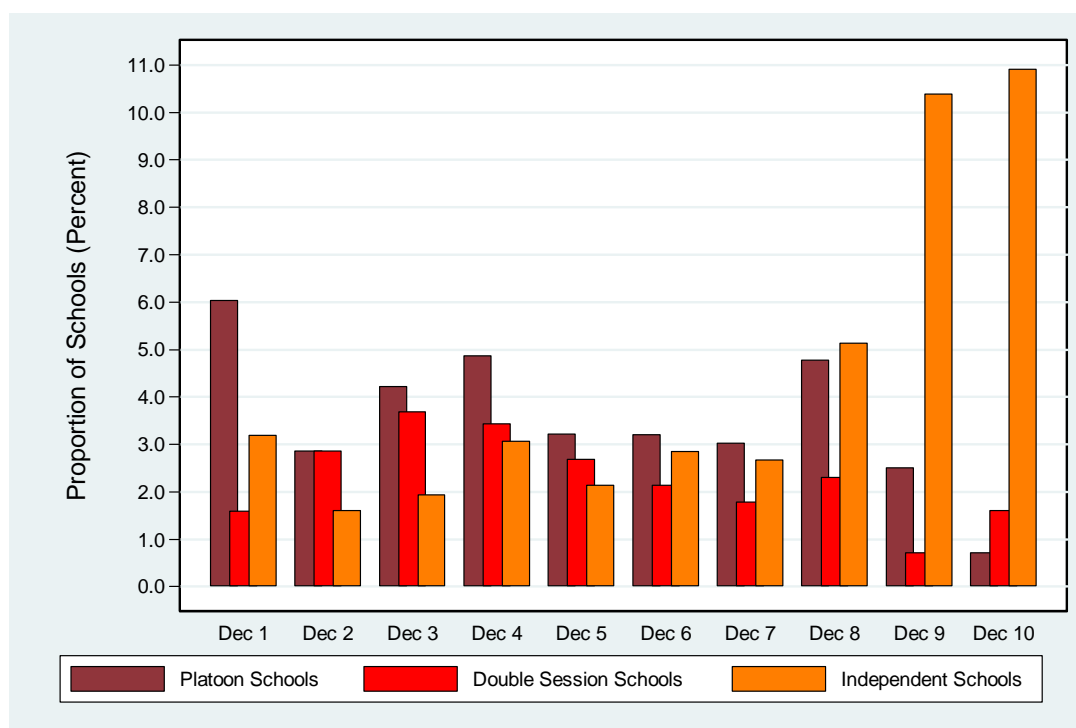
b. Other Institutional Characteristics

The ways in which schools operate will arguably have some bearing on the performance of their learners. One important distinction to make in the South African context is between government and independent schools. The term 'independent school' tends to conjure up images of exclusive, wealthy, high quality private schools. However, in South Africa, this is not necessarily the case. Figure 10 below presents the incidence of, amongst others, independent schools across the performance deciles and reveals that independent schools are to be found in all ten deciles. As one would expect, the incidence of independent schools is significantly higher in the best performing deciles, with 10.9 percent and 10.4 percent of the schools in deciles ten and nine respectively being independent schools. By decile eight, the incidence has fallen to 5.1 percent and ranges between 1.5 percent and 3.2 percent in the bottom seven deciles.

Constraints in terms of physical infrastructure give rise to two phenomena known as platooning and double sessioning. Platooning refers to a situation where two separate schools, each with its own learners, share the same school buildings. One school uses the buildings in the mornings, while the other has use during the afternoons. A double session system is sometimes applied at schools that have too many learners given the size of the school buildings. The learners in a school that applies the double session system are divided into two groups, which have lessons at different times of the day.

Platooning is a more commonly applied system than that of double sessioning overall and in all performance deciles up to decile nine. Fewer than 200 schools (3.6 percent of the total) are platoon schools, while only 128 (2.3 percent) report using the double session system. It is only in the top decile that more schools report applying the double session system than platooning, although the numbers are very low. Platooning and double sessioning appear to be very weakly negatively related to school level matric pass rates. The incidence of both arrangements appears higher amongst schools in the lower deciles and simple correlation coefficients between schools' matric pass rates and the incidence of platooning and double sessioning are -0.0504 and -0.0329 respectively. In contrast, the correlation coefficient between pass rates and an independent school dummy is 0.1297.

Figure 10: Incidence of Platooning, Double Sessions and Independent Schools, by Performance Decile, 2000



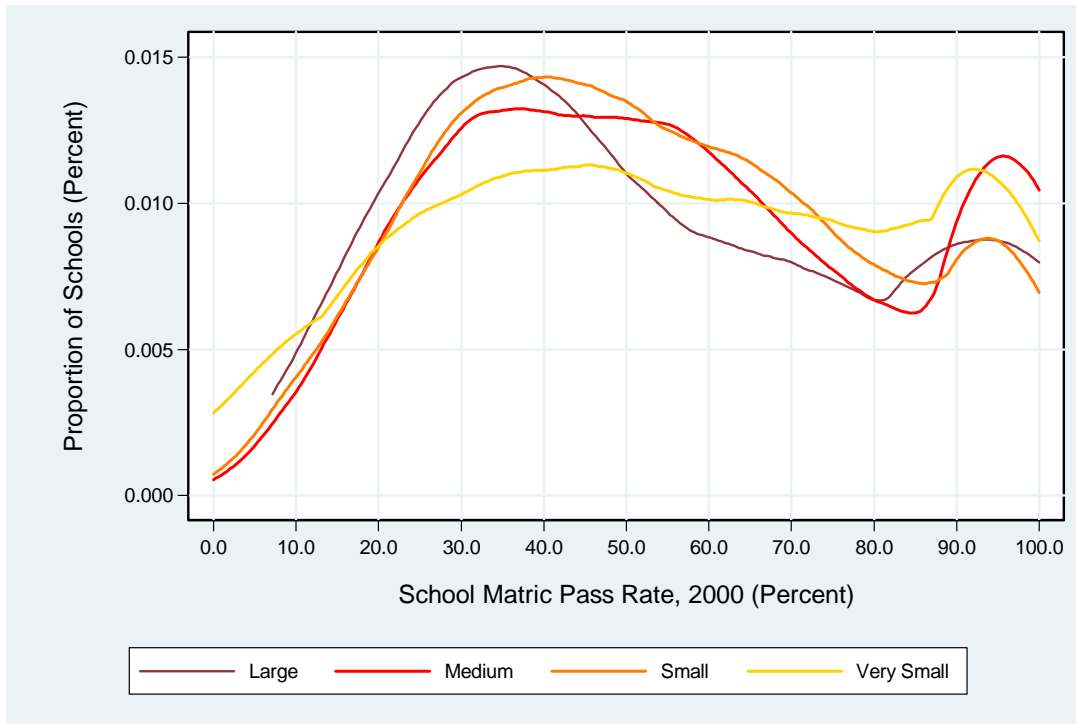
Source: SRN 2000, MR 2000 and Census 2001.

Another issue to consider is the size of the school. The distribution of pass rates presented in Figure 1 led to the consideration of the extent to which school size was underlying the relatively large number of schools at zero and 100 percent pass rates. It was seen that while small schools accounted for a relatively large proportion of schools with zero percent pass rates, they accounted for fewer than one-fifth of schools with perfect pass rates in 2000. In fact, large schools accounted for a large proportion of top performing schools: schools with more than 90 candidates constituted more than 30 percent of schools with no failures in 2000. However, is the distribution of results different for different school sizes?

School size, though, is not an appropriate measure since it is affected by how many grades the school offers. Instead, the appropriate measure of size is, as used above, the size of the matric class or the number of candidates entered for the 2000 examinations or even the average number of learners per grade offered. The former variable is not available in the data, but is probably well proxied by the latter two. Categorising schools according to the number of candidates, four size categories were defined: very small schools with fewer than 50 candidates; small schools with 50 through 99 candidates; medium schools with 100 through 199 candidates; and large schools with 200 candidates or more. In terms of classes, a very small school would be likely to have no more than two Grade 12 classes, a small school no more than four, and a medium school no more than eight (these estimates imply a minimum average of 25 learners per class for Grade 12).

The distribution of school level pass rates are not significantly different across the four size categories (see Figure 11). The distributions for all size categories, except very small schools, peak between 30 percent and 40 percent, with that of very small schools peaking in the mid-40 percent range. All distributions exhibit a hump at the top performance levels.

Figure 11: Distribution of School Matric Pass Rates by Size of Matric Class, 2000



Source: SRN 2000, MR 2000 and Census 2001.

Notes: 1. The size of the matric class is derived from the number of candidates who wrote the 2000 Senior Certificate Examinations. The class is considered very small if fewer than 50 candidates from the school wrote the exam, small if at least 50 but fewer than 100 candidates from the school wrote the exam, medium if at least 100 but fewer than 199 candidates wrote the exam and large if 200 or more candidates wrote the exam.

The similarity of the distributions of the four size classifications demonstrates that small schools do not, on their own, account for an inordinate proportion of schools with no failures. Small schools, however, which constitute 29.7 percent of schools in the dataset, account for almost all schools with zero percent pass rates: 41 of the 43 schools where no candidate passed had fewer than 50 candidates, although only 21 of these had no more than 10 learners. Small schools also account for a relatively large proportion of schools with perfect pass rates (127 of 266 schools), although again only 19 of these schools had no more than ten learners.

4.2 INFRASTRUCTURAL AND RESOURCE CHARACTERISTICS

a. Classrooms

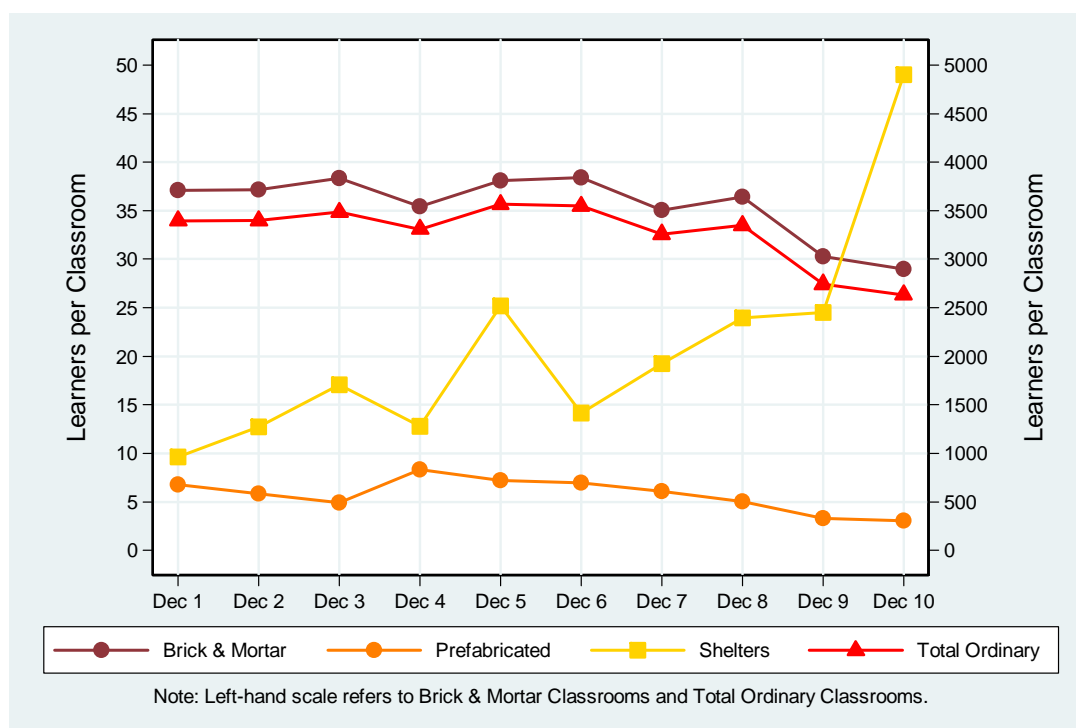
Classrooms are arguably the most important part of a school's infrastructure, being the rooms in which teaching and learning mostly occur. The quantity and quality of classrooms are of interest here since it is believed that the environment in which teaching and learning takes place will have an impact on the quality of educational outcomes. Classrooms can differ substantially from school to school, in terms of construction and purpose and actual use and it is these differences that this section aims to explore.

Since the number of classrooms in a given school is related, in some way, to the number of learners at the school, it is inappropriate to relate classroom numbers to educational outcomes such as the matric pass rate. Consequently, the analysis will control for school size by using instead the number of classrooms per learner. Before the analysis is presented, it is perhaps useful to discuss the types of classrooms as captured in the SRN 2000. The critical distinction that is made in terms of classrooms is that of 'ordinary' classrooms and so-called specialist classrooms, a distinction that is best described by defining the latter. Specialist classrooms are classrooms that are equipped for specific, specialised purposes, and may include such rooms as art centres, biology and physical science laboratories, music rooms, media centres and libraries, and workshops. This means that ordinary classrooms are defined as not being specially equipped for specific purposes. Another separate distinction is made in terms of the construction of classrooms, namely whether they are made of bricks/blocks and mortar, whether they are prefabricated or whether they are merely shelters, the latter having roofs but not necessarily walls. However, this second distinction is made in terms of ordinary classrooms only. Presumably, the underlying assumption is that specialist classrooms would be 'formal' in construction, i.e. at the very least being either prefabricated or made of bricks. Whether this is a fair assumption or not is impossible to determine from the dataset.

Figure 12 below presents the number of ordinary classrooms per learner across the ten performance deciles⁴. For the first eight deciles, the number of learners per ordinary brick and mortar classroom ranged between 34.5 and 38.5. The learner-classroom ratio, however, falls substantially to 30.3 and 29.0 respectively, indicating that, relatively speaking, the best performing schools tend to have more brick and mortar classrooms than other schools. Prefabricated classrooms may not be strictly equivalent to brick and mortar classrooms, but they are substantially closer to brick and mortar classrooms than to shelters in terms of quality. While the first eight deciles report having one prefabricated classroom for every 500 to 830 learners, there is not a constant decline over the deciles. This may have something to do with the degree of 'substitutability' between brick and mortar classrooms and prefabricated classrooms, with the latter not necessarily viewed as inferior once cost considerations are accounted for.

⁴ Since not all schools have all three types of classrooms, calculating learners per classroom by school for the three types would, in many instances, have resulted in incalculable ratios due to division by zero. Instead, the number of classrooms per learner was calculated to avoid this problem and allow averaging over schools within each decile. These averages were thus inverted to obtain learners per classroom for each decile. Thus, even though there are no schools with 5 000 learners, there can be an average of nearly 5 000 learners per shelter in decile ten schools, for example.

Figure 12: Learners per Ordinary Classroom Across School Performance Deciles, by Classroom Construction, 2000

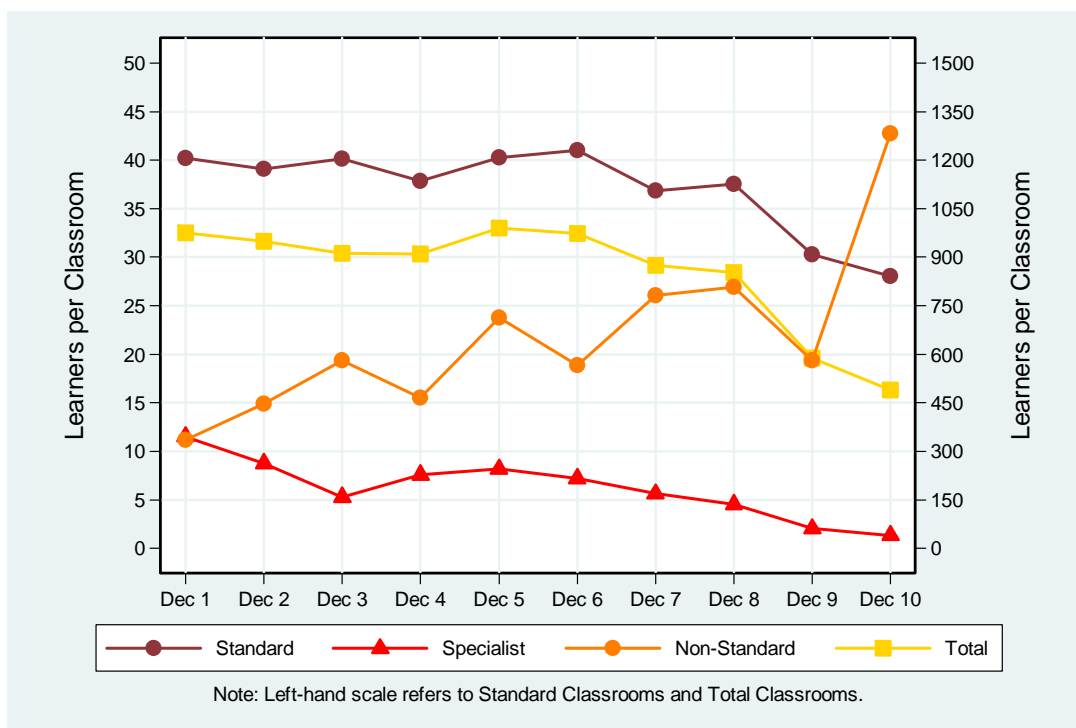


Source: SRN 2000, MR 2000 and Census 2001.

Shelters are unsurprisingly the least common type of classroom across all performance deciles. However, having shelters is related to poorer performance in general, with the lower deciles tending to have significantly lower numbers of learners per classroom. On average, decile one schools have one shelter for every 965 learners, while for deciles two through seven, the number of learners per shelter ranges between 1 000 and 2 000. The only decile that does not fit this pattern is decile five, which has over 2 500 learners per shelter. Decile ten schools have the lowest incidence of shelters, around half that of deciles five, eight and nine, at over 4 900 learners per shelter. In total, however, it appears that the number of learners per ordinary classroom across the deciles is dominated by the pattern observed in the incidence of brick and mortar classrooms. For deciles one through eight, the number of learners per all ordinary classrooms ranges between 32 and 36, and falls to 27.4 for decile nine schools and 26.3 for decile ten schools.

Figure 13 presents learners per classroom according to three classroom types, each of which are mutually exclusive and which, collectively, are exhaustive. The distinction is made between standard classrooms, specialist classrooms and non-standard classrooms. Specialist classrooms have already been defined as being equipped for a particular purpose. Standard classrooms comprise of all permanent brick and mortar classrooms and all prefabricated classrooms, but excludes all classrooms used for non-teaching or non-learning purposes (for example, a room could be designed to be an ordinary classroom, but is used as a staff room). Non-standard classrooms, on the other hand, comprise of shelters, classrooms in non-instructional areas (for example, a store room used as a classroom) and temporary classroom accommodation off the school premises.

Figure 13: Learners Per Classroom Across School Performance Deciles, by Classroom Type, 2000



Source: SRN 2000, MR 2000 and Census 2001.

In 2000, the average number of learners per standard classroom hovered around 40 for the lowest six deciles, whereafter it declined to approximately 37 in deciles seven and eight. In decile nine schools there were around 30.3 learners per standard classroom, compared to just 28.1 learners in decile ten schools on average. In contrast, the number of learners per non-standard classroom rises dramatically across the deciles. Decile one schools have, on average, 337 learners per non-standard classroom, compared to 1 283 learners on average in decile ten schools. The rise, however, is not even or continuous, with the number of learners per non-standard classroom lower in deciles four, six and nine compared to their preceding and following deciles. This upward trend appears to indicate that poorer performing schools are under pressure in terms of their ability to provide regular classrooms for all learners. Learners per specialist classroom decline as performance decile increases, meaning that better performing schools have relatively more specialist classrooms than other schools. In decile one, schools have an average of 346 learners per specialist classroom and it is only after decile seven that the average falls below 150 learners. Decile nine schools have one specialist classroom for every 61 learners and those in decile ten have one for every 40 learners. Stated differently, decile ten schools have nine times as many specialist classrooms, relative to their number of learners, than decile one schools.

The total number of learners per classroom is dominated by the number of learners per standard classroom, indicating this type of classroom's prevalence. Deciles one through six have one classroom, of any type, for every 30 to 35 learners. This ratio falls to between 28 and 30 in decile seven and eight schools, under 20 for decile nine schools and a mere 16 in decile ten schools. Consequently, decile ten schools have around twice as many classrooms of any description relative to their learner numbers than schools in the poorest performing six deciles.

Figure 12 and Figure 13 therefore appear to indicate that there is some kind of relationship between the number of learners per classroom and school performance. This is not only true at the aggregate level, but also for various categories of classrooms. In terms of classrooms of inferior construction or that were not intended for use as classrooms, the relationship between number of learners per classroom and school performance is positive: more learners per 'inferior' classroom, i.e. relatively fewer 'inferior' classroom is correlated with superior school performance. In terms of specialist classrooms, the relationship is negative with those deciles that have more learners per classroom performing more poorly (since more learners per specialist classroom means fewer classrooms relative to learner numbers). Interestingly, though, while the figures above tend to point to relatively clear relationships, actual correlation coefficients are relatively low in most cases, the exception being specialist classrooms and total classrooms.

b. Teachers

The role of teachers in the education process is critical, since the learning of skills and concepts occurs under their supervision. As a result, specific attributes of teachers are seen as playing important roles in the extent to which and the efficiency with which knowledge and skills are transferred to learners. Further, teacher quality is not even across schools. For example, Van der Berg (2001: 407-408) estimates that teacher costs per pupil in 1997 in mainly African schools (schools with at least 70 percent of learners being African) was R2 137, compared to R3 792 in mainly White schools, the difference being attributed to earnings differences based on differences in teacher qualifications and experience. The SRN survey is, however, not focussed on teachers and their characteristics. Alternative data sources for information about teachers were considered, including the Annual School Survey (ASS) and PERSAL⁵. Unfortunately, the ASS data is incomplete and does not include teacher information, while PERSAL, on the other hand, requires a huge investment of time in order to match the data to schools data for a questionable benefit.

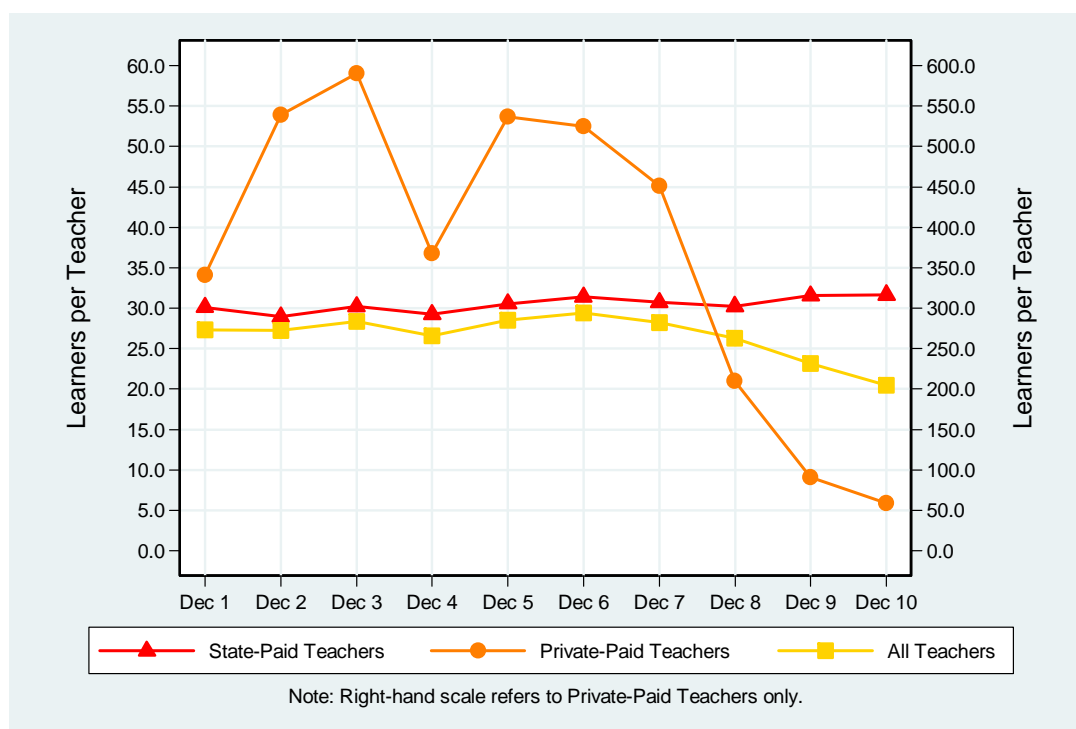
The only real teacher-related data that is available in the dataset is the quantity variable, distinguished by whether the teachers are paid by the state or are paid privately. Consequently, it is possible to calculate learner-teacher ratios for schools based on these characteristics. Figure 14 presents the learner-teacher ratios for state-paid and private-paid teachers, as well as for these two groups combined, averaged across schools in the ten performance deciles. It is clear, firstly, that significant progress has been made towards achieving even learner-teacher ratios across schools. There is very little difference in the average learner-teacher ratios across performance deciles. The ratios vary around 30 learners per state-paid teacher, with poorer performing schools actually having slightly more state-paid teachers relative to their better performing counterparts. Thus, in deciles one and two there are an average of 29 or 30 learners per state-paid teacher, compared to approximately 31.5 learners per teacher in better performing schools. These figures are similar to the 2001 estimate for all ordinary public and independent schools of 33.1 learners per teacher (Department of Education 2003a: 10).

In contrast, there is a vast difference in schools' access to private-paid teachers. Schools at the bottom end of the performance distribution are highly unlikely to have non-state paid teachers. The average decile one school has over 340 learners for every private-paid teacher, while for the bottom seven deciles, there are on average 478 learner for every private-paid teacher. However, the situation for schools in the top three deciles is significantly better.

⁵ The problems experienced with these two datasets were described in greater detail in the first report of this project, *Technical Report on Data Sources*.

Decile eight schools have around 210 learners per private-paid teacher, falling to 91 learners in decile nine schools and 59 learners in decile ten. To put this in perspective, in decile one there are 11.3 state paid teachers for every one private-paid teacher, while in decile ten there are 1.9 state paid teachers for every private-paid teacher. Obviously, these figures are affected by the uneven distribution of independent schools, but if these schools are removed from the calculation, the difference in the state paid teacher to private-paid teacher ratios in deciles one and ten is of a similar magnitude, at 33.9 and 3.3 respectively.

Figure 14: Learner-Teacher Ratios Across Learner Performance Deciles, by Type of Teacher, 2000



Source: SRN 2000, MR 2000 and Census 2001.

The combination of the relatively similar ratios of learners per state-paid teacher across deciles and the large difference in the ratio of learners per private-paid teacher across deciles result in a falling total ratio. The overall learner-teacher ratio remains relatively constant across the first seven deciles, ranging between 26.5 and 29.4 learners per teacher. In decile eight, the learner-teacher ratio falls to below 26.3 and in deciles nine and ten the ratio is 23.2 and 20.5 respectively.

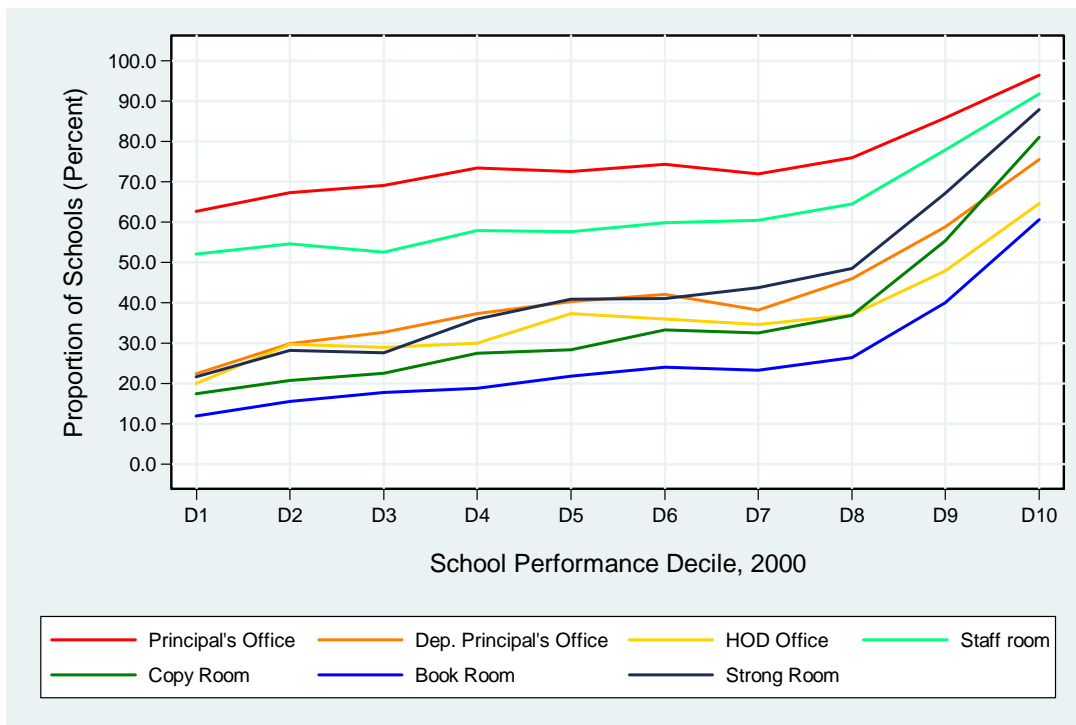
The lack of a relationship between the learner-teacher ratio for schools in deciles one through eight is a rather interesting finding and one that is counter-intuitive, particularly given popular debate around classroom sizes. What this figure, therefore, seems to suggest is that although the learner-teacher ratio varies little in the lower seven or eight deciles and is therefore uncorrelated with school performance, for deciles eight, nine and ten, there seems to be a negative relationship between school performance and class size, with smaller classes apparently related to better performance.

c. Access to Specific Facilities

Historical differences in the resourcing of schools by the apartheid era education authorities has resulted in varying levels of access to teaching and non-teaching facilities across schools. As was shown above, better performing schools tend to have more and better quality classrooms, in terms of both construction and equipment, than schools with lower matric pass rates. This section highlights the differences in access to various facilities at schools.

Good school administration plays an important role in promoting the smooth and successful running of schools. Hence, facilities that aid administration may impact positively, or at least have a non-negative impact, on school performance. The SRN 2000 collects information on schools' access to various administration related rooms and offices. Average levels of access to administration-related facilities are presented in Figure 15 below. Schools were asked in the survey to indicate how many of each of the various facilities they possessed and the access rates below were calculated as the proportion of all schools who reported having one or more of the relevant facilities.

Figure 15: Access to Administration-Related Facilities Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

Access to seven administration-related facilities is presented, namely access to principals' offices, deputy principals' offices, head of department offices, staff rooms, copy (photocopying or duplicating) rooms, book rooms (storage rooms for textbooks and other books) and strong rooms. What is immediately clear from the figure is that access rates for all seven facilities increase as performance increases, with only rare instances of declines in access at higher performance levels. Overall, three-quarters of schools have a principal's office, while 62.9 percent have staff rooms. However, looking at performance deciles reveals that better performing schools are generally more likely to have principals' offices and staff

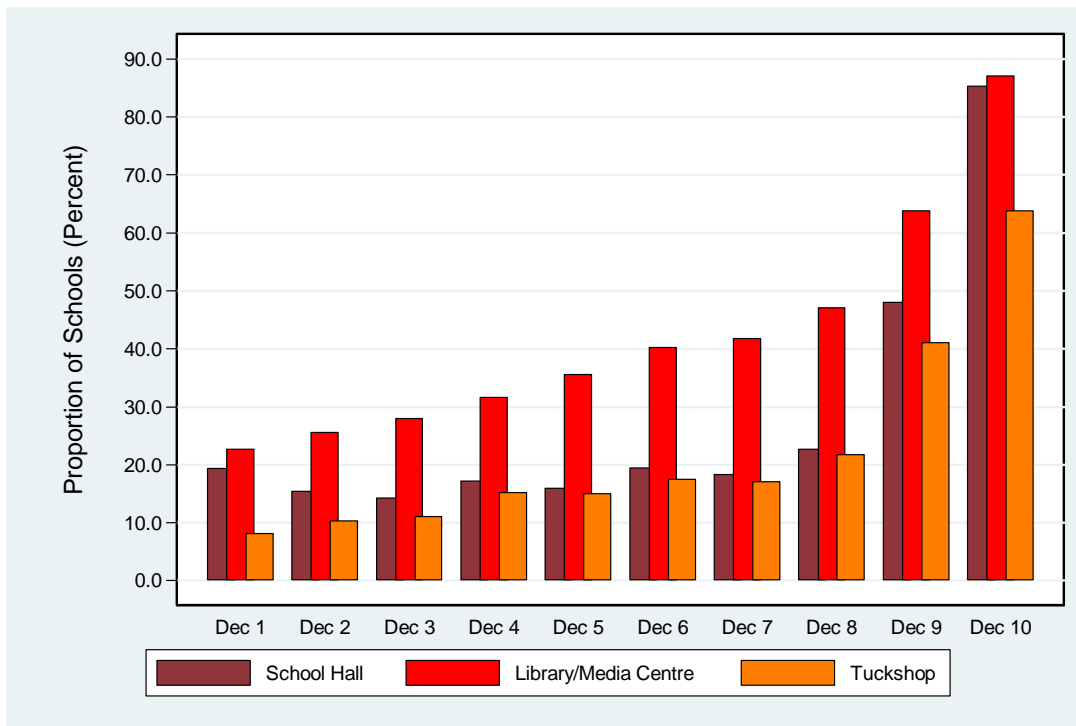
rooms. Thus, in decile one, access to these two facilities is 62.7 percent and 52.0 percent respectively, rising to 75.9 percent and 64.4 percent in decile eight respectively and to 96.4 percent and 91.8 percent in decile ten schools respectively. This is equivalent to an increase of more than one-half and three-quarters respectively over the ten deciles.

Even more substantial are the increases in access to the other five facilities. The decile ten access rate for book rooms, at 60.6 percent, is more than five times that of decile one schools, while for copy rooms the ratio is 4.7 times and for strong rooms it is 4.1 times. The ratio for access to deputy principals' offices and head of department offices are 3.4 and 3.2 respectively. While these figures suggest a positive relationship between access to administration-related facilities and school performance, it is important to note the fact that, for the first eight deciles, access rates rise only gradually, with large increases occurring between deciles eight and ten.

Although there are numerous other facilities included in the SRN questionnaire, space limitations prevent a full discussion of each. However, schools' access to three other facilities is presented in Figure 16, namely access to a school hall, to a library or media centre and to a tuckshop⁶. Access rates for all three facilities are positively related to school performance. Schools most often have access to a library or media centre (42.3 percent of all schools), compared to 27.5 percent that have a school hall and 22.1 percent that have a tuckshop. In decile one, access rates are significantly lower than the average. Only 19.4 percent have a school hall, 22.7 percent have a library and 8.2 percent have a tuckshop. Interestingly, though, the proportion of decile one schools that have school halls is comparable to the proportions in deciles six and seven, with lower access rates in deciles two through five resulting in a rough J-curve. From decile eight to decile nine, the access rate doubles to 48.0 percent and to decile ten it almost doubles again to 85.3 percent.

⁶ A tuckshop is a small 'shop', operated either privately or by the school, that sells food (e.g. hotdogs, pies, hamburgers, etc), snacks and cooldrinks to learners from a location on the school's premises. Proceeds are often considered part of the school's fundraising.

Figure 16: Access to Other Facilities Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

A similar, though slightly less pronounced, pattern is evident in access to libraries and media centres. Further, access rates always increase as one moves from lower to higher deciles. Just over one-fifth or 22.7 percent of schools in decile one have a school library or media centre, a proportion that rises to 47.1 percent in decile eight, and 87.1 percent in decile ten. The pattern of access to a school tuckshop is similar to the pattern of numerous other variables investigated thus far. For deciles one through seven, access rises gradually from 8.2 percent to 17.1 percent respectively. Thereafter, however, the rate of access rises rapidly to 41.0 percent amongst decile nine schools and 63.9 percent in decile ten schools. This constitutes the largest relative increase in access rates over the ten deciles of these three facilities of over 680 percent. In contrast, the relevant increases for school halls and libraries are 341 percent and 283 percent respectively.

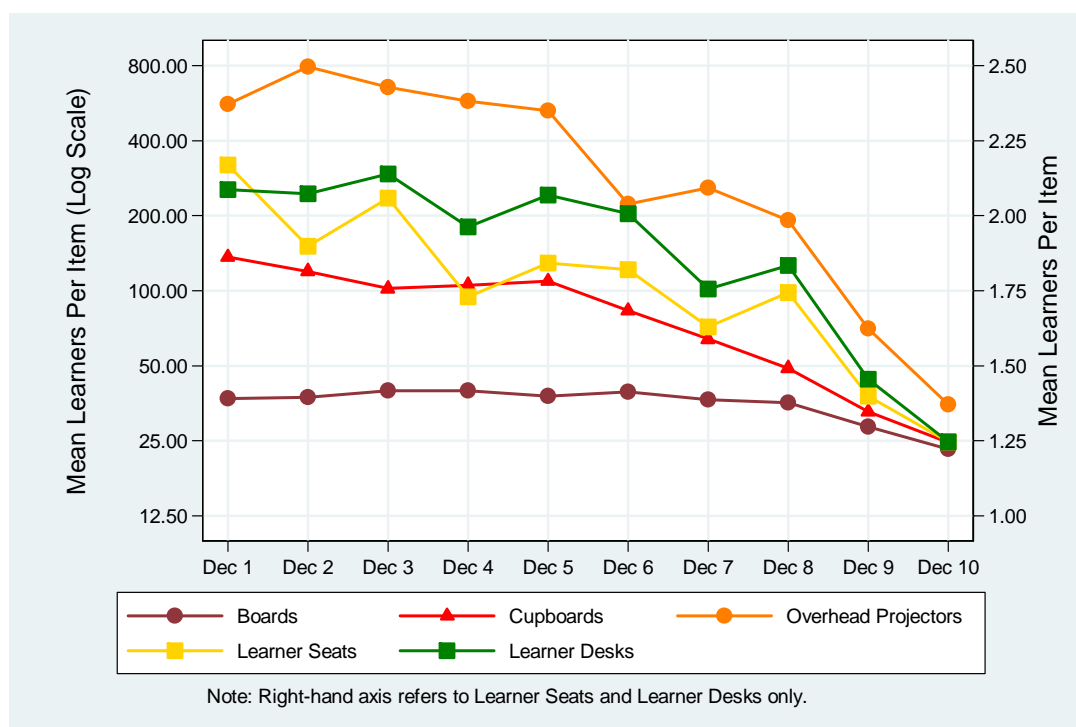
d. Access to Specific Equipment

The SRN survey includes a number of questions regarding a wide variety of equipment available in classrooms, in the school generally and for both teaching and administrative purposes. Once again, quantities on their own will be insufficient for comparisons across schools and, therefore, school size has been controlled for by calculating quantities per learner. In other words, rather than use the number of learner seats, we use the number of learner per learner seats, allowing for meaningful comparisons across schools.

Figure 17 below presents details on classroom equipment, specifically boards (chalkboards and whiteboards), cupboards, overhead projectors, learner seats and learner desks. The general pattern evident for all five variables is either relatively constant or gradually decreasing over deciles one through eight and, thereafter, significant decreases to deciles nine and ten. The greatest relative differences over the deciles are for overhead projectors and cupboards. On average, decile one schools had around 97 learners per

cupboard, compared to 48 learner per cupboard in decile eight and around 21 learners per cupboard in decile ten. Thus, the number of learners per cupboard in decile ten schools is lower than that in decile one schools by a factor of 4.7 to one. Similarly, the number of learners per overhead projector decreased from 386 in decile one, to 202 learners per projector in decile eight, to 32 learners per projector in decile ten. In relative terms, decile one schools have more than 12 times as many learners per overhead projector compared to decile ten schools.

Figure 17: Classroom Equipment Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

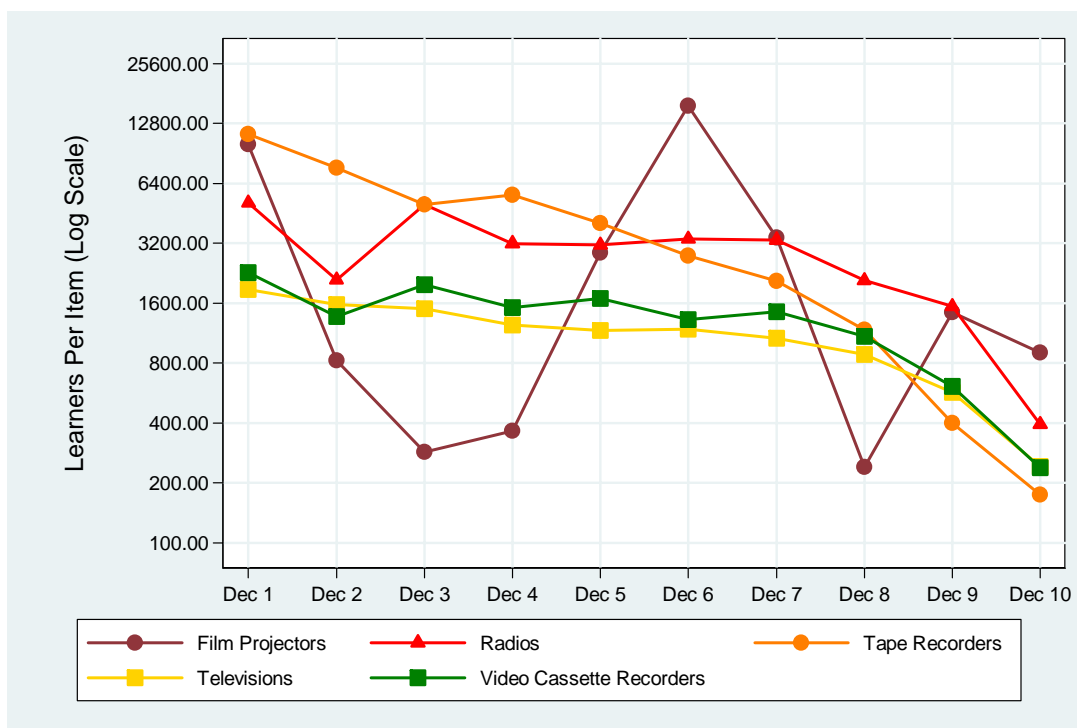
Notes: 1. Figures were calculated by totalling the number of items across all schools within each decile and dividing by the total of learners across all schools within each decile.

In terms of learner seats and desks, the two ratios are relatively similar in each decile. In decile one schools, there is an average of close to two learners per seat and per desk. One way of thinking of these specific ratios is that in decile one, one school may have sufficient desks and seats for its learners, while another has neither seats nor desks for its learners. By decile eight, little change has occurred in the ratios: there are 1.6 learners per seat and 1.8 learners per desk on average. However, this improves to 1.2 learners per seat and 1.3 learners per desk in decile nine schools. In decile ten schools, nearly nine out of ten learners have seats and a marginally smaller proportion have desks.

Access to five types of audiovisual equipment is presented in Figure 18, namely film projectors, radios, tape recorders, televisions and video cassette recorders. Excluding film projectors, access to all types of audiovisual equipment rises considerably over the deciles (indicated by a falling number of learners per item), although average access rates are very low. The average school has one film projector for every 3 611 learners, one radio for every 2 927 learners, one tape recorder for every 4 027 learners, one television for every 1 130 learners and one video cassette recorder (VCR) for every 1 353 learners.

The difference in access between schools in decile one and those in decile ten is striking. In decile one, on average, schools have one radio for every 5 147 learners, compared to every 3 336 learners in decile seven and 394 learners in decile ten. Similarly, in terms of access to televisions, the ratio falls from 1 862 learners per television in decile one to 1 071 learners in decile seven and 241 learners in decile ten. For tape recorders, the difference is even more pronounced: decile one schools have an average of one tape recorder per 11 413 learners, compared with just 174 learners in decile ten schools. Overall, therefore, decile ten schools have eight times more televisions, nine times more VCRs, 13 times more radios and a massive 66 times more tape recorders per learner than decile one schools. Even relative to decile nine schools, the difference is marked: roughly speaking, decile ten schools have twice as many tape recorders, twice as many televisions, three times more VCRs and four times more radios per learner than decile nine schools.

Figure 18: Audiovisual Equipment Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

Notes: 1. Figures were calculated by totalling the number of items across all schools within each decile and dividing by the total of learners across all schools within each decile.

As mentioned, access to film projectors does not follow the same broad pattern exhibited by the other four types of equipment in the figure. Rather, access to film projectors is highly unstable, ranging from over 10 000 learners per projector in decile one, down to 290 in decile three, to almost 15 700 learners in decile six, to 240 learners in decile eight. The reason for this is unclear, but may relate to patterns of equipment updating if one assumes that televisions and VCRs would tend to replace film projectors. Further, patterns of updating may have differed systematically in the apartheid era and the unstable access rates may be a relic of these, amongst other, factors.

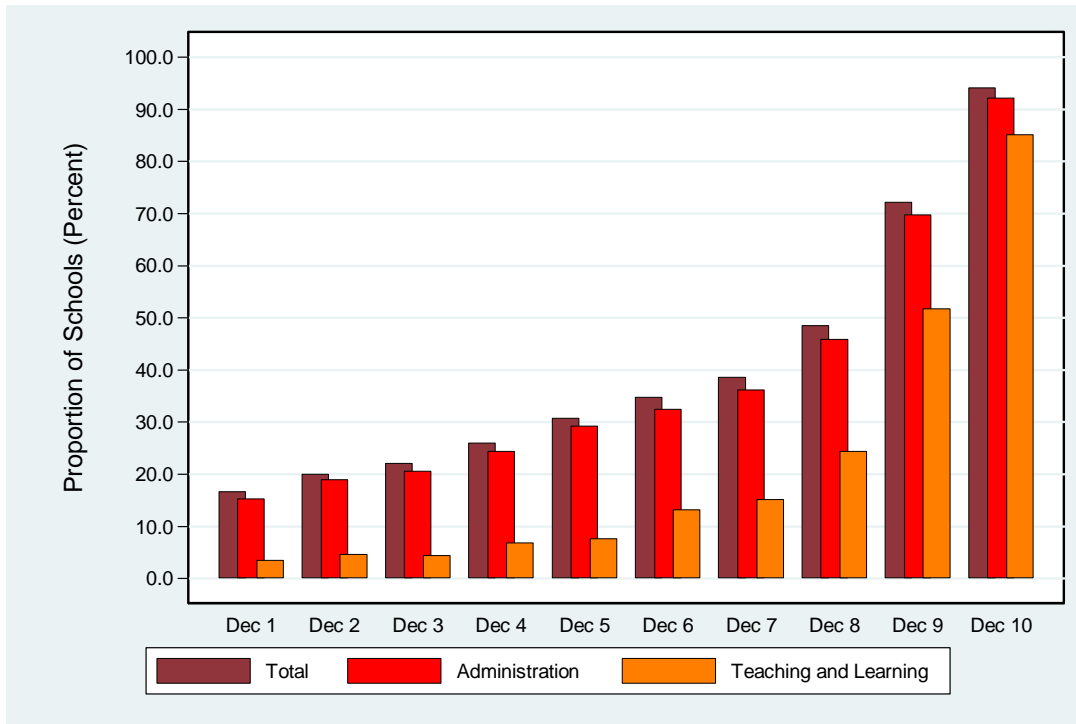
Finally, we turn to possibly one of the most talked about types of equipment at schools, given recent and current global trends and South Africa's dearth of technical expertise. The introduction of computers in schools in South Africa is not a recent

phenomenon, going at least as far back as the 1980s. Obviously, however, it is highly probable that their introduction would have been biased along racial lines given the level of resourcing of schools under apartheid. Currently, the continued extension of computer facilities to schools is hampered by various factors, including lack of qualified personnel and of parallel facilities and services (such as electricity).

These difficulties are, to a certain extent, evident in Figure 19 below. The figure presents computer access rates according to the purpose for which the computers are used, namely teaching and learning and administration. In other words, the actual number of computers at each school is not the issue here, but rather the binary variable of whether or not schools have computers (irrespective of quantity) for these two purposes. Overall, two-fifths of schools report having computers, whether for administration or teaching and learning. Almost all schools with computers (around 95 percent) use at least one of them for administration, while just over one-half use at least one computer for teaching and learning. This implies that, by 2000, computers were still vastly underutilized in schools, but particularly so as a teaching and learning tool.

Further, the figure reveals that the vast majority of schools using computers in for whatever purpose are in the upper deciles of the performance distribution. Overall, only 16.7 percent of decile one schools use computers and even in decile eight the proportion of schools using computers remains below one-half. It is only in deciles nine and ten that the majority of schools are using computers (72.2 percent and 94.1 percent respectively). The use of computers for administration purposes tracks the overall use figures closely and is never more than three percentage points lower than the overall proportion in each decile. While the overall use of computers is biased towards better performing schools, the bias is even more pronounced in terms of the use of computers for teaching and learning. Under five percent of schools in deciles one through three use computers for teaching and learning, while this is true of fewer than 25 percent of schools even in decile eight. Only 51.8 percent of decile nine schools use computers for teaching and learning, compared to 85.2 percent of decile ten schools. In fact, almost two-thirds of schools that use computers for teaching and learning are located in the top two performance deciles in 2000.

Figure 19: Access to Computers Across School Performance Deciles, by Use, 2000



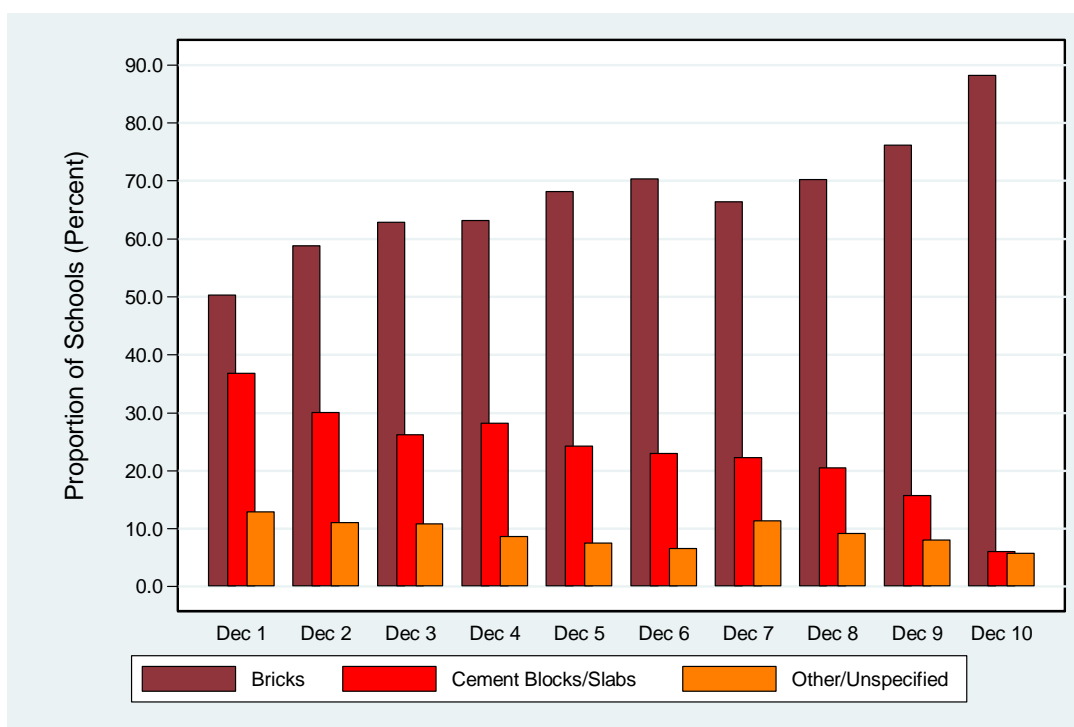
Source: SRN 2000, MR 2000 and Census 2001.

e. General Construction and Condition of School Buildings

The School Register of Needs Survey of 2000 asks principals to describe the general construction of their schools' buildings, as well as to assess their general condition. In particular, details are elicited from principals regarding the buildings' walls, floors, ceilings and roofs, which are presented below.

The majority of schools have brick walls, irrespective of school performance (Figure 20). In total, this is true of more than two-thirds of schools with matric results for 2000. Decile one schools are, however, least likely (50.3 percent) while decile ten schools are most likely (88.2 percent) to have brick walls. Where schools do not have brick walls, most report having walls constructed of cement blocks or slabs (23.3 percent). The proportion of schools with cement block walls is highest in decile one (36.8 percent), declining gradually to 6.1 percent in decile ten. However, it is not clear that cement blocks are necessarily an inferior construction material for walls and, if these two construction types are ignored, it is clear that very few schools report any other type of construction material. The incidence of other construction materials is only 9.2 percent overall, although this tends to be greater poorer performing schools. Approximately 13.0 percent of decile one schools report a type of construction other than brick or cement block, compared to 5.7 percent in decile ten schools. Interestingly, the use of other construction materials is unexpectedly higher in deciles seven, eight and nine, given the general trend in the bottom five deciles.

Figure 20: Construction of Walls Across School Performance Deciles, 2000

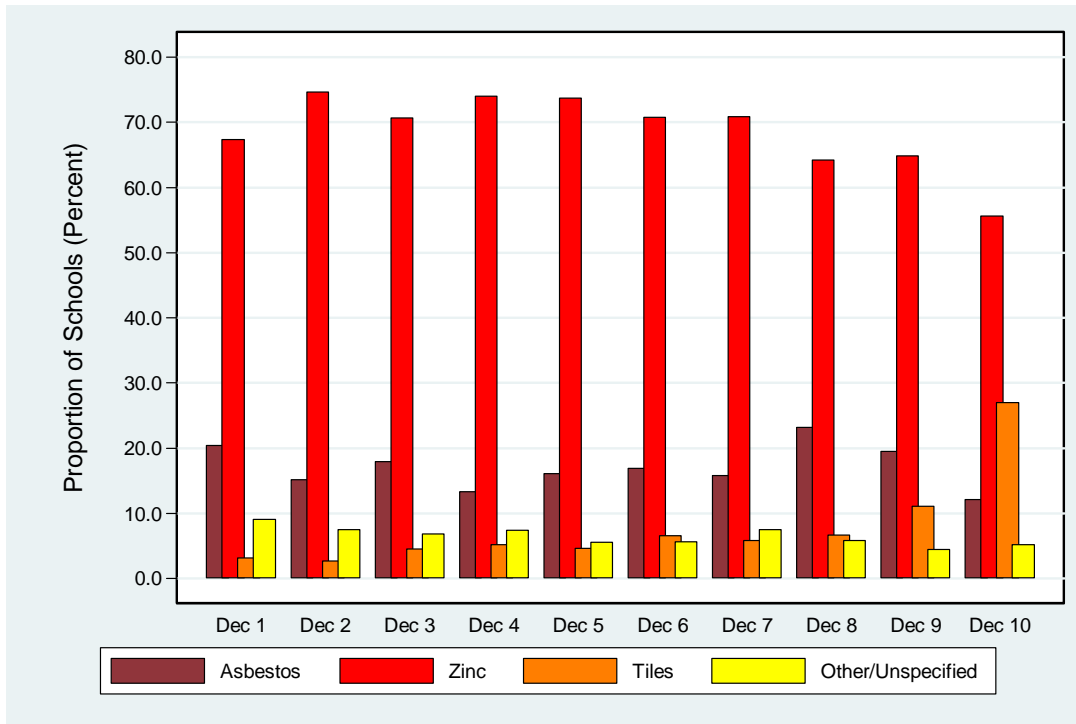


Source: SRN 2000, MR 2000 and Census 2001.

Notes: 1. Apart from bricks and cement blocks/slabs, schools could identify mud or clay, zinc or prefabricated as wall construction materials, while an 'other' category was also included in the questionnaire.

The overwhelming majority of schools have zinc roofs, irrespective of performance decile (Figure 21). In total, less than one-third of schools do not have zinc roofs. Although poorer performing schools tend to be more likely to have zinc roofs, the pattern is not a consistent one, with the highest incidence being amongst schools in deciles two through five. A further 17.1 percent of schools have asbestos roofs, while only 7.8 percent have tiled roofs. The incidence of asbestos roofing fluctuates between ten and 20 percent, with only deciles one and eight having rates of incidence in excess of 20 percent. Across the performance deciles, it is only in decile ten that the proportion of schools with tiled roofs surpasses the proportion with asbestos roofs.

Figure 21: Construction of Roofs Across School Performance Deciles, 2000

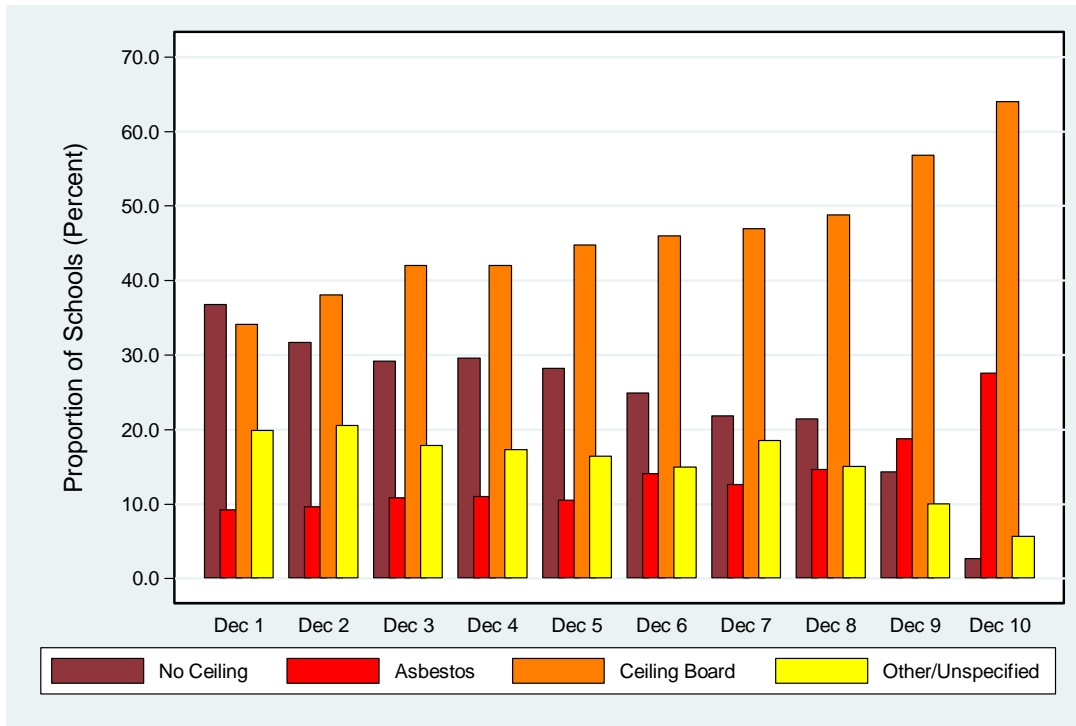


Source: SRN 2000, MR 2000 and Census 2001.

Notes: 1. Apart from asbestos, zinc and tiles, schools could identify thatch as a roof construction material, while an 'other' category was also included in the questionnaire.

The correlation between school resources and performance is clearly discernible when ceiling construction is used as the proxy measure for the former variable (Figure 22). The three main categories of ceiling construction as revealed in the data are ceiling board (46.4 percent of schools), no ceiling (24.1 percent) and asbestos (13.9 percent). Schools without ceilings tend to do more poorly than those with ceilings made of asbestos or ceiling board. In decile one, 36.8 percent of schools have no ceilings, while the same is true of more than 25 percent of schools in deciles two through five. It is only in decile nine that the proportion of schools with no ceilings falls below 20 percent to 14.3 percent, while in the top performing decile the proportion is only 2.7 percent. In contrast, the incidence of asbestos ceilings rises from 9.2 percent in decile one to 18.8 percent in decile nine and 27.6 percent in decile ten. This gradual increase over the first eight deciles, followed by a rapid increase in deciles nine and ten, is a pattern that is observable in numerous other variables. It is also evident in the incidence of ceilings made of ceiling board. This rises from 34.1 percent in decile one (lower than the proportion of schools with no ceilings) to 48.9 percent in decile eight and 56.8 percent and 64.0 percent in deciles nine and ten respectively.

Figure 22: Construction of Ceilings Across School Performance Deciles, 2000

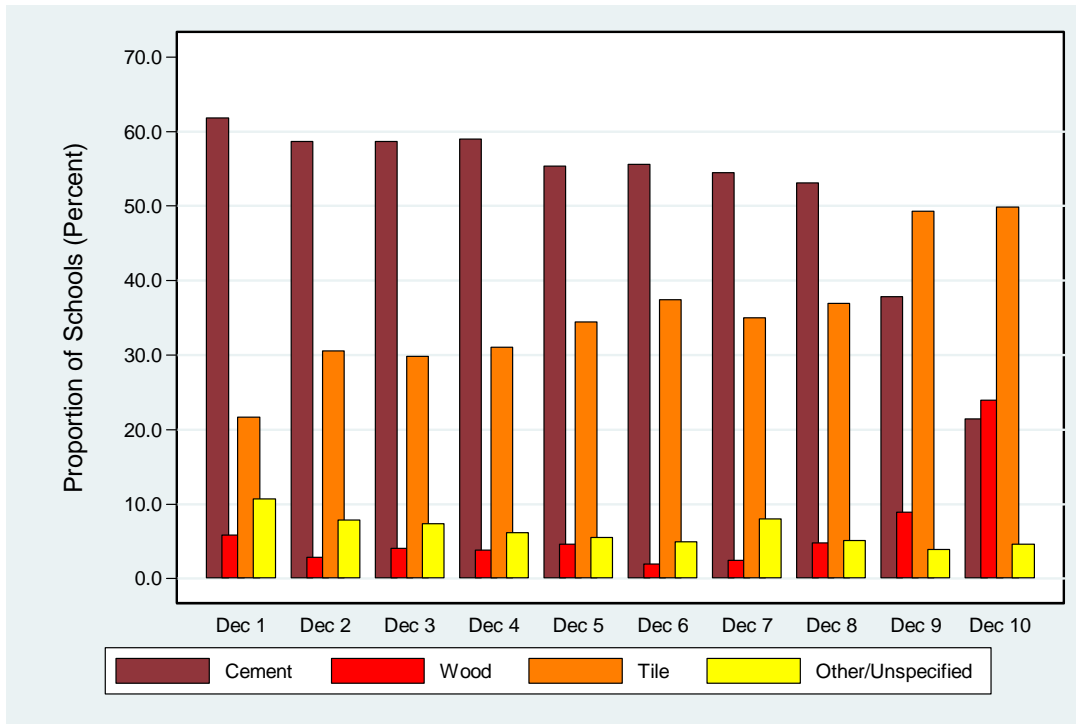


Source: SRN 2000, MR 2000 and Census 2001.

Notes: 1. Apart from asbestos, ceiling board and no ceiling, schools could identify wood as a ceiling construction material, while an 'other' category was also included in the questionnaire.

Floor construction also appears to be correlated with school performance (Figure 23). Overall, cement and tiled floors dominate as the most often used materials for floor construction. More than one-half of schools (52.6 percent) report having cement floors, while a further 35.6 percent have tile floors. However, the distribution of the former is biased towards more poorly performing schools while that of the latter is biased towards better performing schools. Thus, in deciles one through eight, schools reporting having cement floors constitute the majority, while in deciles nine and ten tile those reporting tile floors are the largest group. Although only 6.3 percent of schools have wooden floors, this is highly skewed towards schools in the top decile. Less than six percent of schools in the bottom eight deciles report having wooden floors, compared to 9.0 percent in decile nine and 24.0 percent of decile ten schools. Thus, wooden floors are more common than cement floors in the top decile. This surge in the incidence of wooden floors in the top decile can, perhaps, be linked to the fact that many formerly White schools are relatively old and have kept their wooden floors in their often historical buildings.

Figure 23: Construction of Floors Across School Performance Deciles, 2000

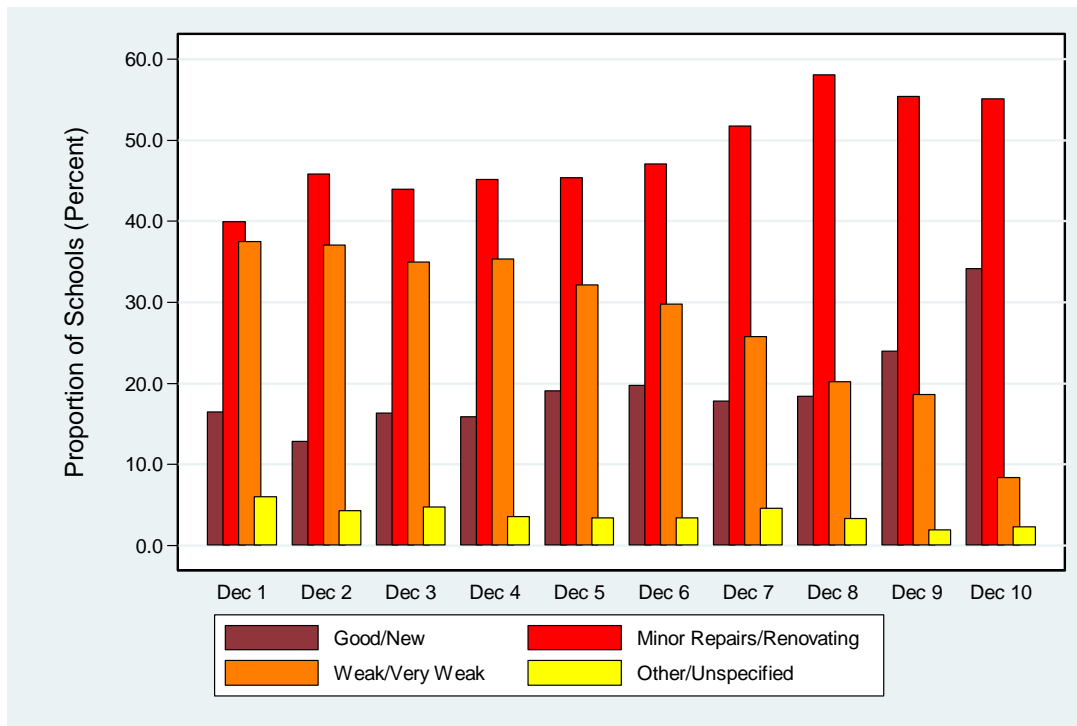


Source: SRN 2000, MR 2000 and Census 2001.

Notes: 1. Apart from cement, wood or tile, schools could identify ground or mud as a floor construction material, while an 'other' category was also included in the questionnaire.

School principals are also asked to assess the general condition of the school buildings. Schools can be classified as very weak, weak, needing paint and minor repairs, good condition, new or currently being renovated or upgraded. Figure 24 groups these responses into four categories namely good condition or new schools, schools needing minor repairs or that are currently being renovated, schools whose buildings are weak or very weak, and schools with other or no responses. The distribution of schools with buildings that are new or in good condition is biased towards the better performing end of the distribution. This group accounts for between 12 percent and 20 percent of schools in the bottom eight deciles, compared to 24.0 percent and 34.2 percent respectively of schools in deciles nine and ten. In contrast and unsurprisingly, schools reporting the condition of school buildings to be weak or very weak tend to be located in the lower deciles. Between 30 percent and 40 percent of schools in deciles one through five have weak or very weak school buildings, compared to only 8.4 percent of decile ten schools. Schools needing minor repairs or that are currently undergoing renovation constitute the dominant group in all deciles, but particularly so in the top four deciles. It therefore appears that poorly performing schools in 2000 were most often the schools with buildings in the worst condition. The question does require a judgement call on the part of school principals in classifying the condition of the school buildings, which may distort the true distribution, although it is uncertain as to the way in which the results would be distorted.

Figure 24: General Condition of School Buildings Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

f. Schools' Access To Services

Schools' access to services such as water and electricity can have a major impact on the quality of education received by learners. Schools without electricity, for example, are excluded from fully engaging with modern electricity-dependent technologies in the classroom, while a lack of electricity may also hamper administrative efficiency. A parallel argument is applicable where schools lack access to water. The SRN survey asks a number of questions related to schools' access to services, while also having more textured information about the sources of such services.

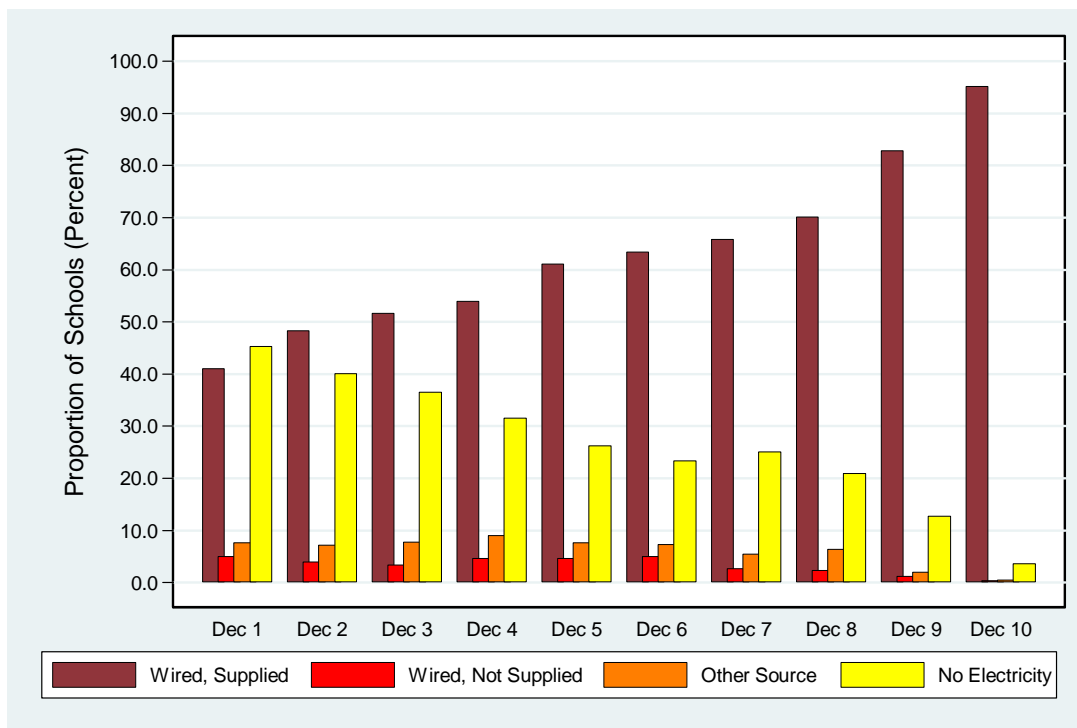
Schools are asked whether they have power for lighting and what their type of power supply is. Figure 25 combines these two questions to provide an aggregate picture. Four categories are presented, namely wired and supplied with electricity, wired but not supplied with electricity, other power sources (including generators, solar power and other sources) and no electricity at all.

The patterns derived in the figure are not surprising. The proportion of schools wired and supplied with electricity increases as one moves through the deciles. Only 41.0 percent of decile one schools have access to electricity from the national power grid, compared to between 60 percent and 70 percent in deciles five through seven, and 95.2 percent in decile ten. In other words, while three in five decile one schools do not have access to electricity from the power grid, this is true of only one in twenty decile ten schools. Conversely, the proportion of schools with absolutely no access to electricity in any form declines as performance improves, from 45.3 percent of schools in decile one to between 20 percent and 30 percent in deciles five through eight, and to a mere 3.6 percent in decile ten schools. This means that, in decile one, more schools have no access to any form of electricity than have access to power from the grid. The proportion of schools with non-grid sources of electricity

and the proportion of schools that are wired but not supplied with electricity are very low, remaining below ten percent. There is also no clearly discernible pattern to the proportions across deciles, except for the fact that the proportions decline considerably in deciles nine and ten in particular. Unfortunately, there is no information as to why schools may be wired but not supplied with electricity and it is therefore not possible to determine whether this reflects a situation whereby schools are in the process of being connected to the grid, or whether schools have been disconnected from the grid due, for example, to non-payment, or whether schools are not supplied because of theft or vandalism done to the nearby electricity infrastructure.

As mentioned, the lack of electricity in a school hampers teachers' and learners' engagement with various technologies and the high proportion of schools lacking electricity (26.6 percent of all schools) indicates that this is a serious problem. Further, it is possible that the functional lack of electricity is underestimated in the figure. This is due to the fact that the question refers to the source of electricity for lighting purposes as opposed to other, general purposes. Further, where power sources are unstable (e.g. susceptible to power surges) or unreliable, schools are less likely to make the investments in equipment required such as computers and projectors. On the positive side, though, since the survey was undertaken in 2000, it is possible that a number of schools have since been connected to the power grid, or have been equipped to generate their own electricity.

Figure 25: Source of Electricity for Lighting Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

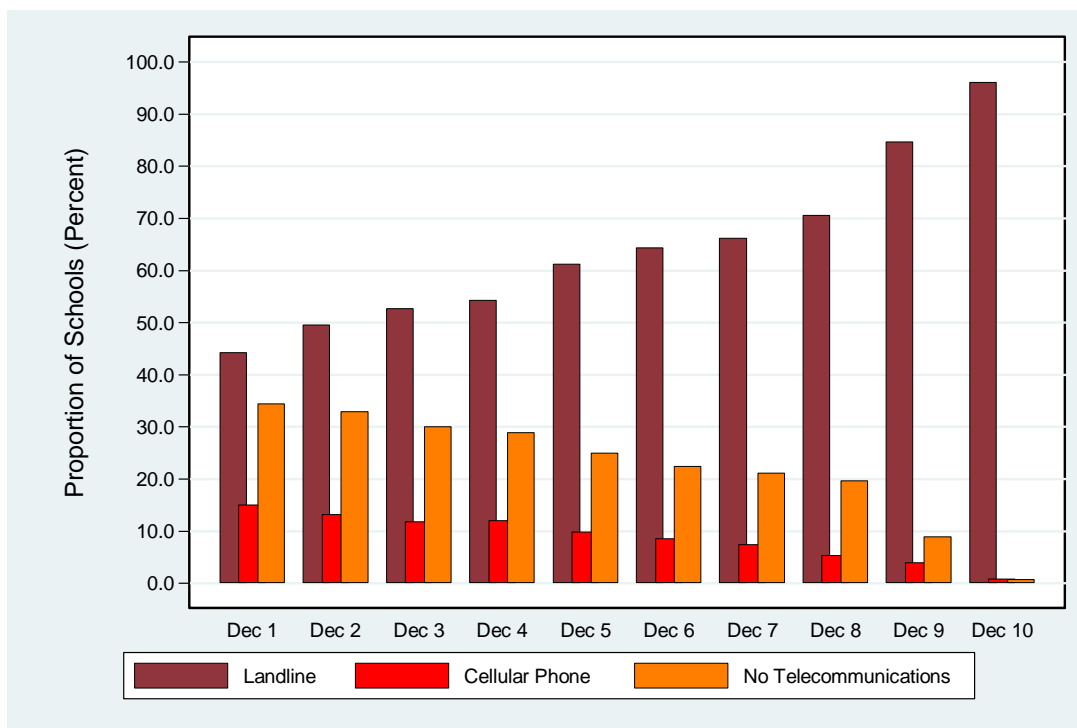
Vast improvements in access to telecommunications have occurred in the post-apartheid period. This has occurred through the extension of landline services into rural and other previously overlooked areas, as well as through the rapid expansion of cellular telephony. The pattern of schools' telephone access in 2000 is presented in Figure 26 below and is likely to have improved in the five years since. In general, most schools have access to landlines (64.4 percent), while a further 8.8 percent do not have access to a landline but do

have access to a cellular phone. In total, 1 259 schools, or 22.4 percent, have no access to a telephone of any description.

Once again, access varies according to performance. Access to landlines and cellular phones is respectively lowest and highest in decile one schools. Under 45 percent of schools in decile one have landlines, while 34.5 percent have no access at all. Landline access rises as performance improves, rising over 25 percentage points between deciles one and eight and a further 25 percentage points from decile eight to ten. Thus, landline access is close to universal in the top decile (96.1 percent). In contrast, the proportion of schools without access to any kind of telephone falls as performance improves. This decline is initially relatively gradual, with sharp declines in the top two deciles.

Cellular telephone access for schools, like people, seems to be correlated with lack of landline access. In other words, cellular telephony appears to substitute for landline telephones where the latter are unavailable. Thus, while 15.1 percent of decile one schools have only cell phones, this proportion gradually erodes as one moves through the deciles to 0.9 percent of decile ten schools. Combining landline and cellular telephone access results in a more gradual increase in access over the deciles, although the difference between deciles one and ten remains substantial.

Figure 26: Access to Telecommunications Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

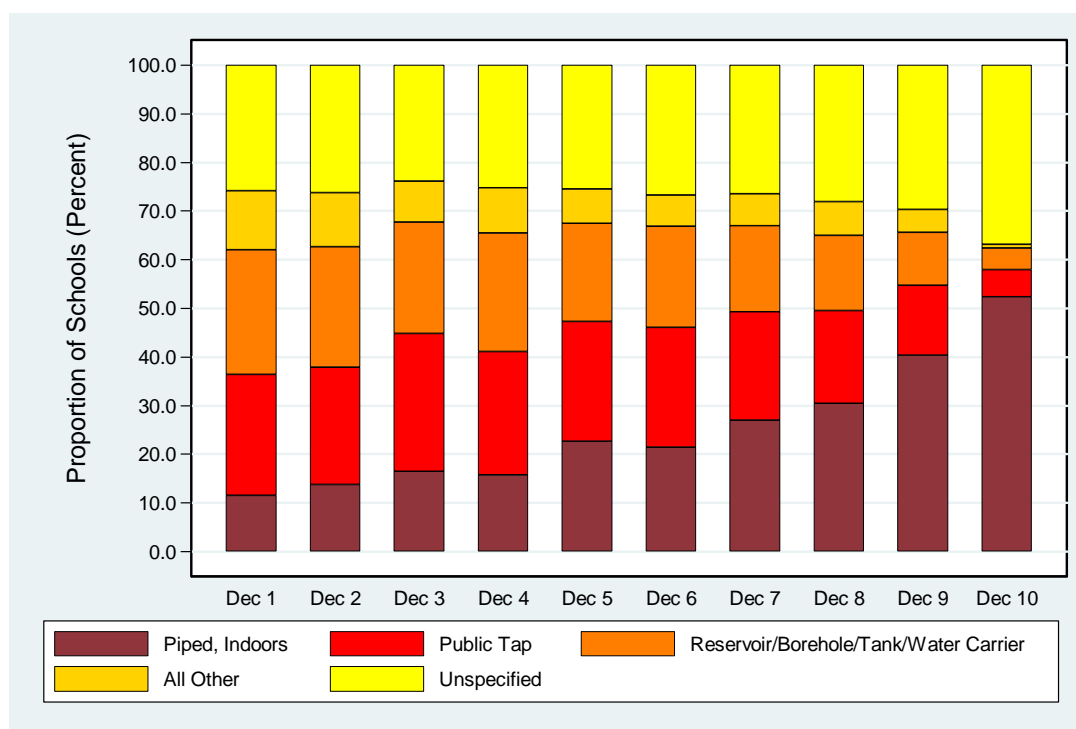
As is the case with other household services, there has been significant expansion in households' access to water since 1994. Unfortunately, the question regarding schools' access to water was relatively poorly answered, with 27.5 percent of schools in dataset not reporting the type of water access. The proportion of non-responses is relatively stable and only increases noticeably in deciles nine and ten, where non-responses account for 29.8 percent and 36.9 percent respectively. Schools were originally asked to report the type of water source on the school premises and, if the school had no water source on-site, they were

asked to describe the nearest off-site water source. These two questions were then combined to form a single water source variable. The method of delivery of water to schools is correlated with performance, with 'superior' methods more common amongst better performing schools and vice versa.

Schools with access to indoor piped water account for only 11.6 percent of schools in decile one, rising to 20 percent to 30 percent in deciles five through seven. Almost 40 percent of decile nine schools report having piped water indoors, and the same is true of 52.4 percent of decile ten schools. In contrast, the proportion of schools with access only to public taps, either on or off-site, declines as performance improves, although the decline is not greater than the increase in the proportion with indoor piped water. Thus, in combination, the proportion of schools with access to some kind of piped water (either indoors or via a public tap) still increases with performance.

More than one-quarter of schools in 2000 had to rely on sources of water that were not piped, such as reservoirs, boreholes, water tanks and carriers, or rivers, with poorer performing schools reporting using these types of water sources most often. In decile one, 25.6 percent of schools obtain water from reservoirs, boreholes and water tanks and carriers, while a further 12.1 percent of schools obtained water from other sources. In contrast, the proportions in decile five were 20.2 percent and 7.0 percent respectively and in decile ten, 4.5 percent and 0.7 percent respectively.

Figure 27: Source of Water Across School Performance Deciles, 2000



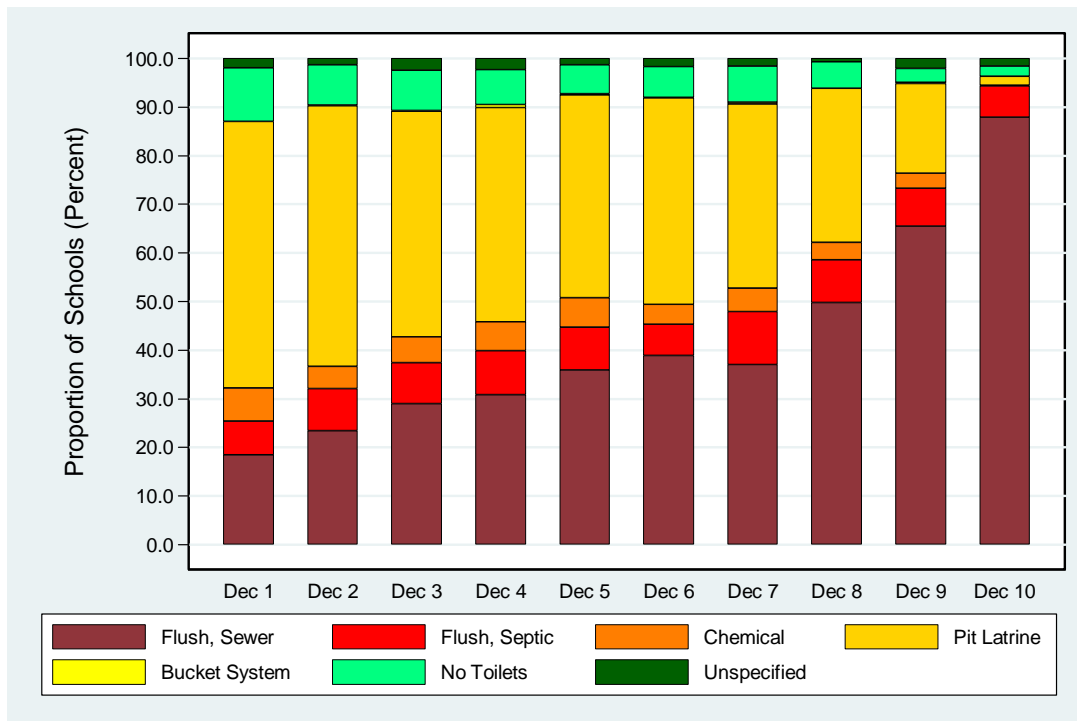
Source: SRN 2000, MR 2000 and Census 2001.

Toilets are another key facility that schools should be able to offer learners. The infeasibility of extending the sewerage system to all areas means that a number of alternative systems are available. Figure 28 presents the proportions of schools reporting five types of toilet facilities, namely flush toilets connected to the sewerage system, flush toilets connected to septic tanks, chemical toilets, pit latrines and the bucket system. Overall, the two most

common types of toilet facilities are flush toilets connected to sewers, which account for 41.6 percent of schools, and pit latrines, which account for 37.3 percent of schools. A further 8.2 percent of schools rely on flush toilets connected to septic tanks and 4.4 percent use chemical toilets. In total, only ten schools report having to rely on the bucket system, while 6.5 percent of schools report having no toilet facilities at all.

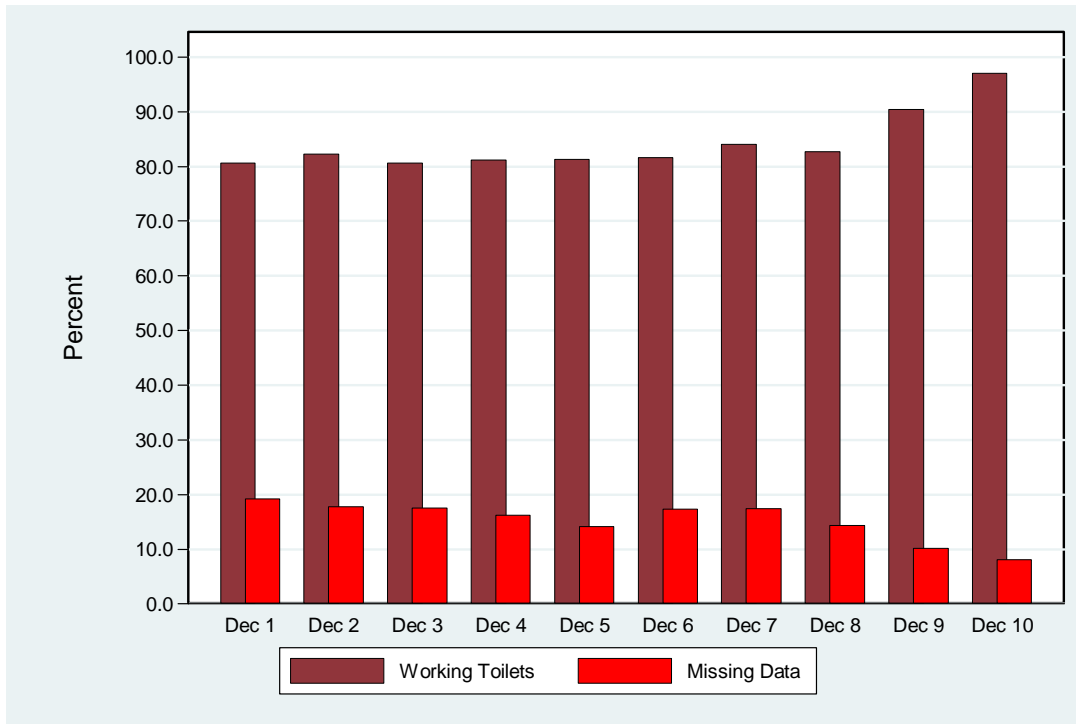
In the bottom seven deciles, pit latrines are the most common type of toilet facility, accounting for between 54.9 percent of schools in decile one and 37.9 percent of schools in decile seven. Thereafter, however, pit latrines become much less common and are used in less than two percent of decile ten schools. Conversely, the proportion of schools relying on flush toilets connected to the sewer system increases as performance improves. Thus, less than one-fifth of decile one schools have this type of flush toilet, compared to one-half in decile eight and almost nine-tenths in decile ten. The use of flush toilets connected to septic tanks is relatively stable, varying in a narrow range of between six and nine percent, except for decile seven where 10.9 percent of schools report relying on this type of toilet. Chemical toilets are relatively uncommon, used by between three and seven percent of schools in deciles one through nine. Only one decile ten school reports reliance on chemical toilets. Schools that lack toilets of any description are more often in the poorer performing deciles, although they can be found in all ten deciles. Around 11.0 percent of schools in decile one have no toilets whatsoever, compared to only 2.2 percent of decile ten schools. As is the case with many variables investigated thus far, the most rapid change in the proportion occurs in deciles nine and ten.

Figure 28: Type of Toilet Facilities Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

Figure 29: Proportion of Toilets Working Across School Performance Deciles, 2000

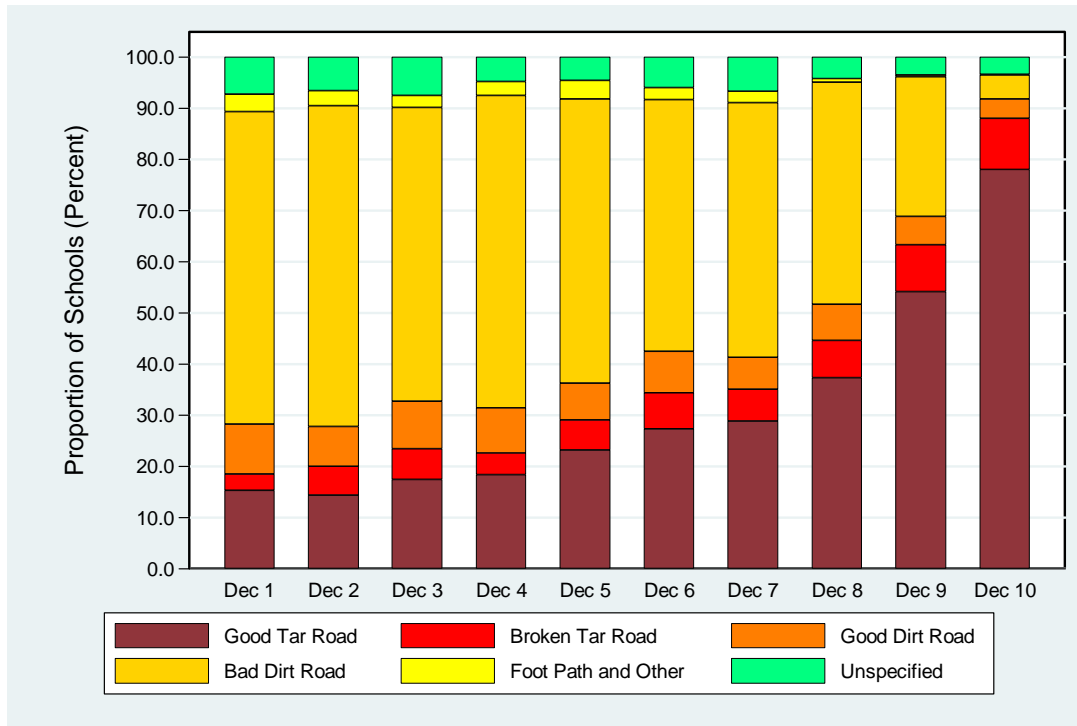


Source: SRN 2000, MR 2000 and Census 2001.

Obviously, in terms of learners' access to toilet facilities, an important factor is the working condition of the toilets that schools have. Figure 29 presents the proportion of toilets that are in working order, averaged across schools within each decile. Overall, 83.4 percent of the average school's toilets are in working order. However, this average obscures the fact that deciles nine and ten differ substantially from the other deciles in that the average proportion of working toilets rises to 90.4 percent and 97.0 percent respectively. Unfortunately, a sizable proportion of schools did not provide sufficient information, with schools in the lower deciles being more likely to not have provided information. This makes it difficult to say for certain what the true proportions are. Further analysis of the data, which is not presented, reveals that flush toilets connected to sewer systems are generally in good condition with 86.0 percent in working order. However, for this type of toilet, there is a marked difference across deciles in the proportion that are in working condition. In decile ten, schools reported an average of 97.5 percent of these toilets in working condition, compared to just 74.0 percent in decile one.

The final type of service considered in this section is that of access roads. Schools need to be easily accessible to learners and the SRN 2000 questionnaire asks about schools' access roads and, where access roads are not tarred, about the distance to the nearest tar road. Access roads or paths are classified as good or broken tar roads, good or poor gravel or dirt roads or only footpaths. Obviously, the distinction between good and poor quality roads is far less clear than the distinction between tarred and dirt roads, while comparisons of quality of, for example, broken tar roads and good dirt roads are problematic. Therefore, the decision was made to leave the classifications as they were in the questionnaire.

Figure 30: Type of Access Road to School Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

Once again, the favoured position of well-performing schools is evident. Tar roads in good condition service 78.0 percent of decile ten schools, compared to 54.1 percent of decile nine schools, and under 20 percent of schools in deciles one through four. Overall, though, only 31.4 percent of schools were serviced by tar access roads, while a further 6.5 percent reported having broken tar access roads. Interestingly, the proportion of schools with broken tar roads was also positively related to performance, with higher deciles having greater proportions of schools with broken tar roads, as is the case with good tar roads. Thus, even though these schools now have poor quality roads, they are located in areas that, at some stage, were not too isolated or unimportant for tar roads.

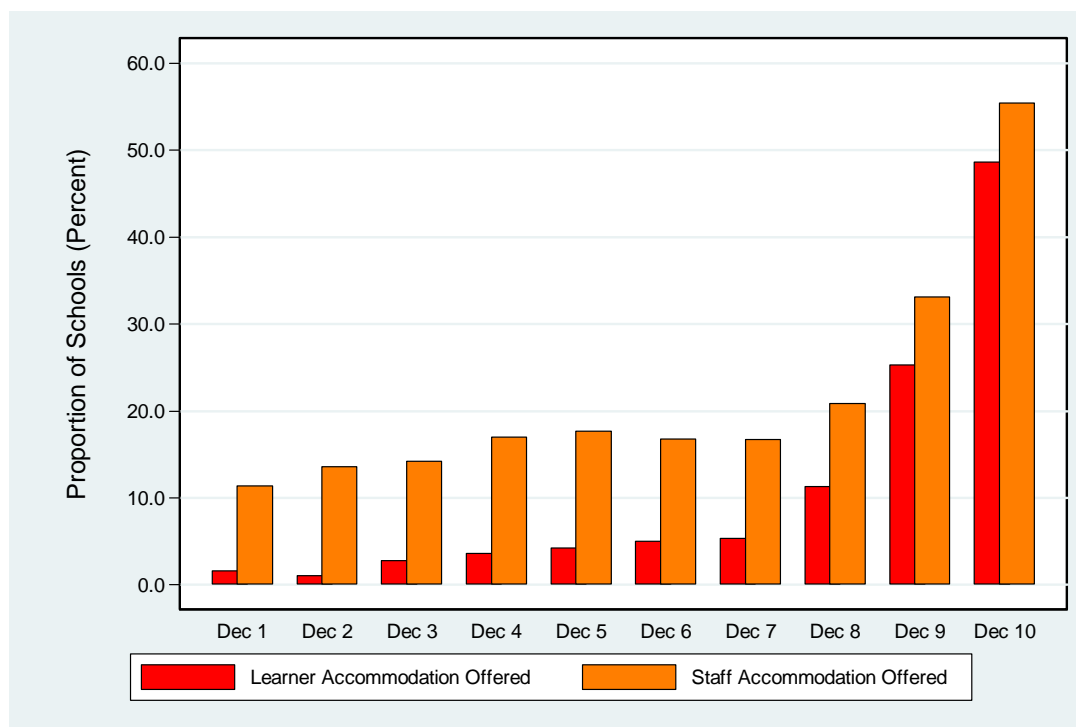
The majority of schools (almost 55.0 percent), however, are serviced by some form of dirt road and, most often, these dirt roads are described by principals as being of poor quality. Only 7.3 percent of schools have good dirt access roads, the proportion being highest in decile one (9.8 percent) and lowest in decile ten (3.8 percent). Similarly, the highest proportion of schools with poor dirt access roads is to be found in decile one (61.1 percent) compared to 27.2 percent and 4.7 percent in deciles nine and ten respectively. In total, therefore, while 70.9 percent of decile one schools are accessed via dirt roads generally, this is true of 32.8 percent of decile nine schools and a mere 8.4 percent of decile ten schools. A similar pattern is evident in the proportion of schools accessed via footpaths and other means, although the proportions are of far smaller magnitudes.

g. Other Characteristics

South African schools, in general, have a long history of offering accommodation to learners and staff alike due in many instances to the fact that schools were not always available in many areas. However, overall, only 10.9 percent of schools report that they offer accommodation to learners in 2000, compared with 21.7 percent of schools that report

offering accommodation to teachers. Figure 31 presents the proportions of schools that offer learner or staff accommodation across each decile and reveals that better performance is related to the likelihood that accommodation is offered. Decile ten schools, therefore, are more than 30 times more likely to offer learner accommodation than their decile one counterparts and almost five times more likely to offer teacher accommodation.

Figure 31: Schools Offering Accommodation Across School Performance Deciles, 2000



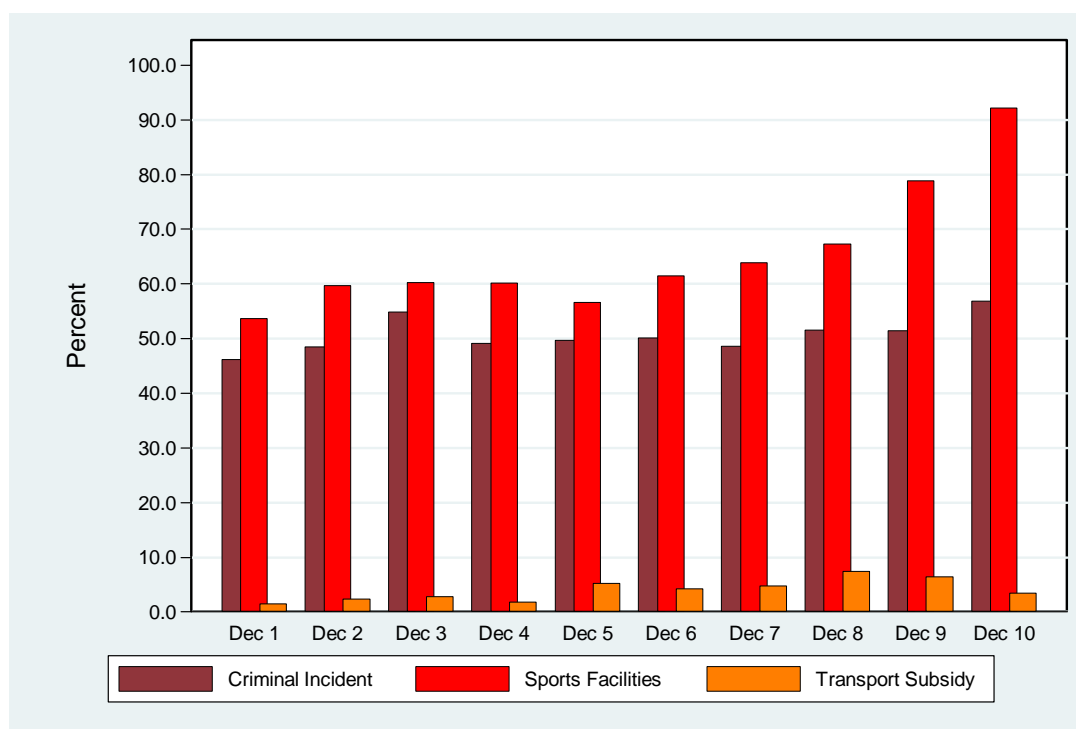
Source: SRN 2000, MR 2000 and Census 2001.

While Figure 31 presents a fairly similar pattern in terms of the proportions of schools in each decile that offer learner or staff accommodation, there is one important difference, namely that the offering of learner accommodation is far more concentrated in the upper performance deciles than is that of teacher education. Less than 5.5 percent of schools in decile one through seven offer learner accommodation, compared with 25.3 percent in decile nine and 48.7 percent in decile ten. This means that more than two-thirds of schools offering learner accommodation are to be found in the top 20 percent of schools. In this instance there appears to be arguments for circular causality, in that top schools attract more learners from further a field because they are known to be top performing schools, while schools that attract more learners from further a field may have to apply some sort of rule that ranks potential learners and possibly selects better performing learners. In contrast, substantially more schools in the lower deciles offer teacher accommodation than learner accommodation. In decile one, 11.4 percent of schools offer teacher accommodation while only 1.6 percent offer learner accommodation. Up to decile seven, between 11 percent and 20 percent of schools offer teacher accommodation. This proportion rises to almost one-third (33.2 percent) in decile nine and 55.5 percent in decile ten. This means that only around two-fifths of schools offering teacher accommodation are located in the top two deciles. Once again, the rapid increase in the variables occurs from around decile eight onwards.

The final three variables that will be presented in this section are a very heterogeneous group, namely the incidence of crime, access to sports facilities and the provision of transport

subsidies. In terms of crime, it is interesting to see that the proportion of schools that experienced crime during the year prior to the survey (i.e. 1999) is relatively constant across the ten deciles, ranging between 46 percent and 57 percent. This seems to imply that schools are general targets for crime and that the fact that a school has experienced a criminal event does not seem to be correlated with its performance.

Figure 32: Incidence of Crime, Sports Facilities and Transport Subsidies Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

The existence of sports facilities at a school is a rough proxy for the level of resourcing of that school. The majority of schools, almost two-thirds, report having sports facilities of some kind in 2000. Access to sports facilities is, in contrast to crime, related to school performance: schools with sports facilities tend to perform better than those that do not. Thus, 53.6 percent of decile one schools report having sports facilities, compared to 63.9 percent of decile seven schools, and 92.1 percent of decile ten schools. In the top-performing ten percent of schools, therefore, only around eight in every 100 do not have sports facilities. As with other variables, the most rapid increase in access occurs between deciles eight and ten.

Fewer than four percent of schools report that the Department of Education subsidises transport for their learners. The incidence of transport subsidies is skewed towards the upper end of the distribution, with more than 55 percent of schools whose learners receive transport subsidies located in the top 40 percent of schools by performance. This is possibly due to the relatively more widespread use of transport subsidies in the Western Cape, whose schools are more often located in the top deciles. In total, 99 of the 224 schools with transport subsidies (equivalent to 44.2 percent) are Western Cape schools, of which 87 are located in the top five deciles. The deciles with the highest proportions of schools reporting access to transport subsidies are decile eight (7.4 percent) and decile nine (6.5 percent).

5. SCHOOL PERFORMANCE AND LOCAL SOCIOECONOMIC CHARACTERISTICS

The focus in this section turns away from the school as such and investigates some of the characteristics of the communities in which schools find themselves. Schools were matched to communities indirectly via their geographical coordinates. Using Geographical Information Systems (GIS) software, it was possible to map schools onto Statistics South Africa's Small Area Layer (SAL) dataset of the 2001 Census.

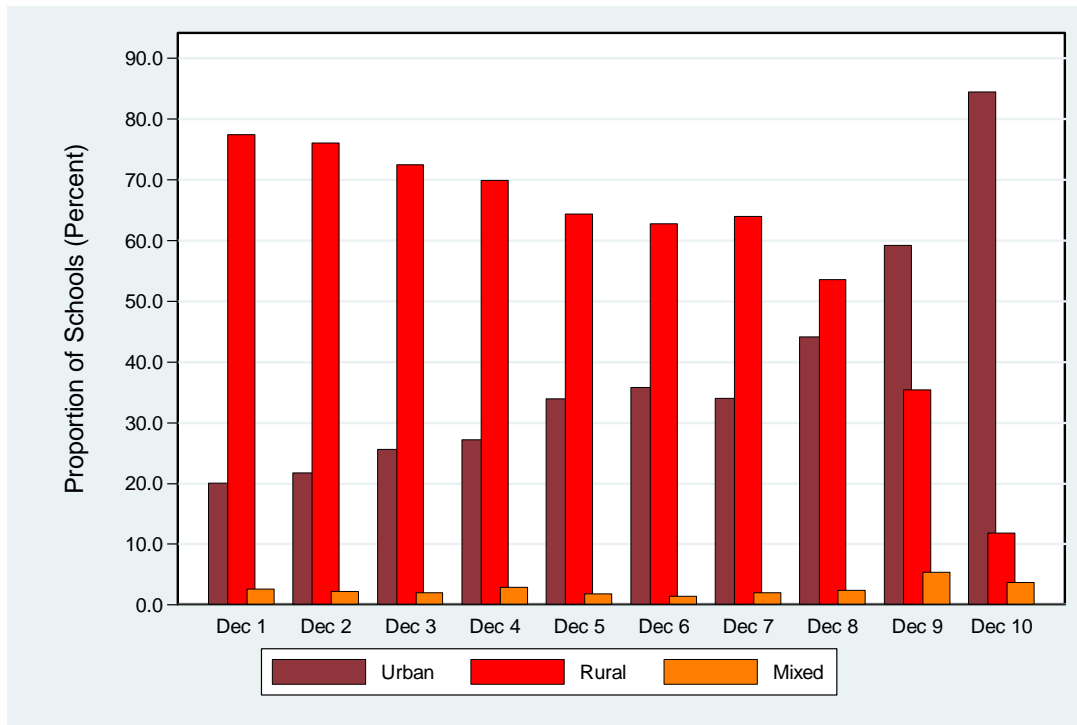
The SAL dataset is basically comprised of sufficiently large enumerator areas (with population in excess of 500 people). Where enumerator areas (EA's) contained fewer than 500 people, these were combined by Statistics SA with other small EAs within the same sub-placename until the population of the resulting 'small area' was large enough. Obviously, however, schools do not draw their learners exclusively from the small areas in which they are located and this means that, ideally, data from the relevant small areas should be incorporated. Unfortunately, it is not possible to identify the small areas from which learners come. One solution would be to take into account the small area in which the school is located, as well as neighbouring small areas, although this could result in a problem similar to the original problem. Consequently, data for only the small areas in which the schools are located is taken into account, resulting in a crude, though usable, proxy.

Having used geographical coordinates to match the datasets, the rural-urban divide is a useful place to begin. Statistics SA uses three categories to describe the type of area in the SAL dataset, namely urban, rural and mixed, where mixed areas are small areas that consist of both urban and rural EAs. Figure 33 presents the distribution of schools in the ten performance deciles according to the type of area. Better performing schools are more likely to be urban than poorer performing schools. In decile one, almost three-quarters (74.1 percent) of schools are in rural small areas, while just under one-fifth (19.2 percent) are in rural areas. In decile seven, the proportion of schools that are in rural areas is still in excess of three-fifths and that in urban areas is around one-third (32.7 percent). Thereafter, there is a rapid increase in the proportion of schools in urban areas as one moves up the deciles, with a commensurate decline in the proportion in rural areas. Thus, by decile nine, urban schools outnumber rural schools by a factor of approximately five to three and, in decile ten, 80.7 percent and 11.3 percent of schools are in urban and rural areas respectively. The proportion of schools in mixed areas is negligible (2.6 percent) and, irrespective of size, is problematic to interpret.

Unfortunately, the SAL dataset contains no direct measure of income or wealth. Therefore, an indirect route must be taken, using access to services and adult education levels to proxy for the extent of deprivation in a small area. Figure 34 presents the average educational attainment of the adult population (over the age of 20 years) in the small areas surrounding schools in each decile. The proportions of adults with low levels of education are lowest in the small areas surrounding the poorest performing schools. In areas around decile one schools, 12.8 percent of the adult population have no education, while 8.9 percent have incomplete primary education. The proportion of adults with no education gradually declines to 10.5 percent in decile seven, although the proportion with incomplete primary education varies only slightly and in decile seven it is 8.7 percent. By decile ten, though, the proportions of the adult population with no education or incomplete primary education have fallen to 3.9 percent and 5.1 percent of the adult population respectively. The proportion of adults with complete primary education ranges between three and four percent, except for decile ten where it falls to 2.2 percent.

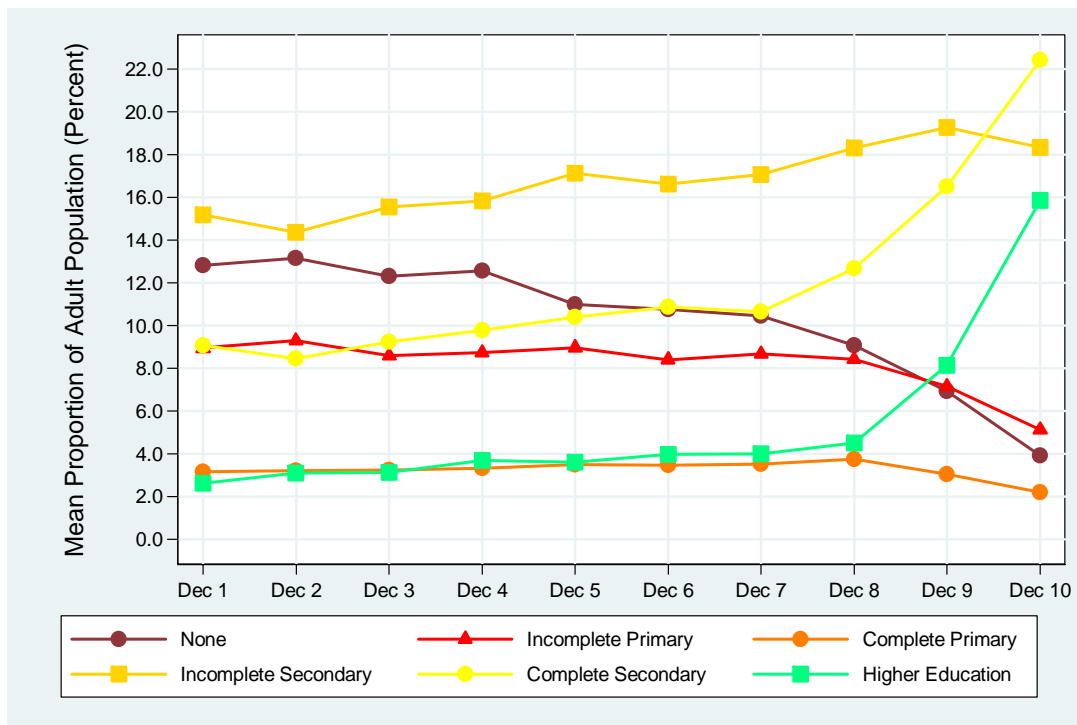
In contrast, the proportion of the adult population with incomplete secondary, complete secondary and higher education is increasing as performance improves. In decile one, 15.2 percent of the adult population in surrounding areas has incomplete secondary, while a further 9.1 percent have matric certificates. Only 2.6 percent of adults in these areas have higher education. By decile seven, under 11 percent of adults have complete secondary education and under four percent have higher education. The proportion with complete secondary education more than double between deciles seven and ten, from 10.7 percent of the adult population to 22.4 percent, while the proportion with higher education almost quadruples over the same deciles. While four percent of adults in small areas around decile seven schools have higher education qualifications, this proportion rises to 4.5 percent in decile eight, 8.1 percent in decile nine, and 15.9 percent in decile ten.

Figure 33: Location of Schools Across School Performance Deciles, 2000



Source: SRN 2000, MR 2000 and Census 2001.

Figure 34: Educational Attainment of Adult (Over 20 Years) Population Across School Performance Deciles



Source: SRN 2000, MR 2000 and Census 2001.

Access, or lack thereof, to household services can serve as a proxy for a household’s standard of living or an area’s level of development, hence the current government’s emphasis on delivery of services to previously neglected areas. For example, Statistics South Africa (2000) calculated ‘development indices’, based on household infrastructural and household circumstance indicators, that measure the level of development in the country’s nine provinces. The household infrastructural variables include some of those presented below, such as (lack of) access to formal housing, access to electricity for lighting and access to tap water. Similarly, recent work by Borhat *et al.* (2006), use similar infrastructural and other variables to calculate provincial poverty indices and track their change between 1993 and 2004. Access rates for specific household services are also used by international agencies, such as the World Bank and the International Development Association (IDA), as proxies for development.

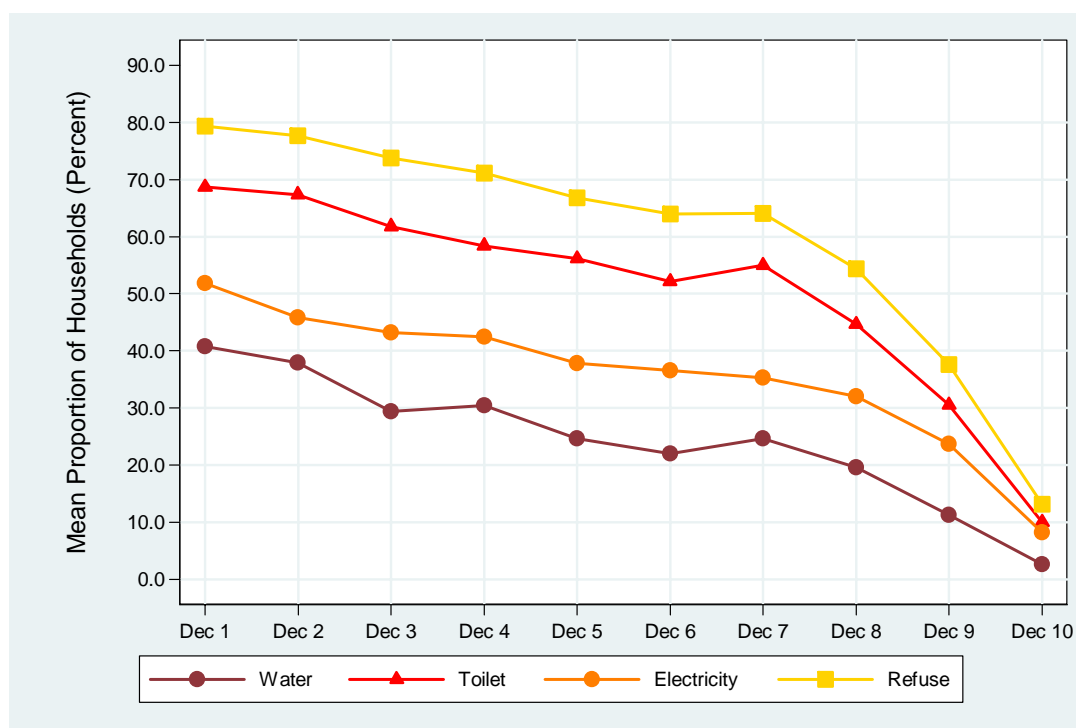
Figure 35 presents the proportion of households in the small areas around schools in each decile that lack access to four household services, namely piped water, hygienic toilets, electricity for lighting and removal of refuse by local authority. Since the graph presents details on the *lack* of access to these services, the higher a particular line is, the poorer households’ access to that service is. Approximately three-fifths (60.2 percent) of households lack access to refuse removal, while around one-half (50.5 percent) do not have hygienic toilets and 35.7 percent do not have electricity for lighting⁷. Slightly under one-fifth of households (24.4 percent) do not have access to piped water. For purposes of comparison, the situation for all South African households is as follows: 43.0 percent of households lack

⁷ It is important to note that aggregate figures presented in this section, unless otherwise stated, are not aggregates for the country as a whole. This is because only those small areas that contain schools are used to calculate the aggregates.

access to refuse removal, 40.5 percent do not have hygienic toilets, 30.3 percent do not use electricity as their main source of energy for lighting, and 26.7 percent do not have access to piped water (own calculations, Statistics South Africa 2003). Only in the case of piped water is lack of access greater for the country as a whole than for household located in ‘school-containing’ small areas. In all instances, lack of access to these services is greater amongst households located near poorer performing schools.

The situation in households near the most poorly performing schools is considerably worse than the average household in ‘school-containing’ small areas, as well as the average South African household. For example, in decile one, 79.2 percent of households lack refuse removal, 68.6 percent lack hygienic toilets, 51.8 percent lack electricity for lighting, and 40.7 percent lack access to piped water. Lack of access for all four services declines gradually from decile one through seven, whereafter it declines steeply. In the case of refuse removal, the proportion of households lacking access declines from 64.1 percent in decile seven to 13.2 percent in decile ten. Similarly, lack of access to electricity falls from 35.3 percent to 8.2 percent, lack of toilet access from 55.1 percent to 10.0 percent and lack of access to piped water from 24.6 percent to 2.7 percent respectively.

Figure 35: Mean Household Lack of Service Access Across School Performance Deciles



Source: SRN 2000, MR 2000 and Census 2001.

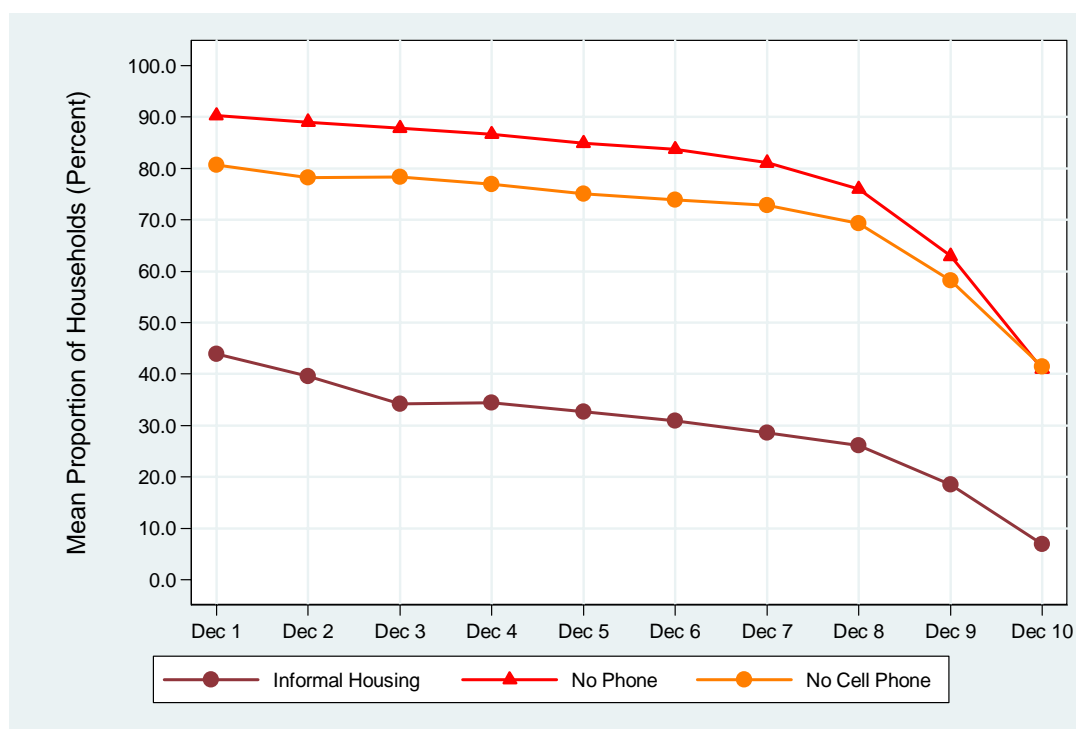
Notes: 1. Access to water includes piped/tap water on a community stand (irrespective of distance), inside yard and inside dwelling. Access to a hygienic toilet includes flush toilets connected to sewerage system or to a septic tank, chemical toilets and pit latrines with ventilation. Access to electricity refers to where households use electricity as their main source of energy for lighting. Access to refuse removal refers to where refuse is removed by the local authority.

The familiar pattern of gradual change up to decile seven, followed by rapid change thereafter, is found in Figure 36, which details households’ level of access to landline telephones and cellphones, as well as the proportion of households that live in informal or traditional dwellings. Overall, 78.4 percent of households in the sample do not have landline

telephones, compared to 70.5 percent that have no access to cellphones. Almost three-tenths (29.6 percent) of households reside in informal or traditional dwellings. In comparison, for South Africa as a whole, 75.6 percent of households do not have a landline telephone, 67.7 percent do not have a cellphone, while 31.2 percent of households reside in informal or traditional dwellings (own calculations, Statistics South Africa 2003).

As is evident from the figure, there is generally very little change in the proportions between deciles one and seven. Lack of access to landline telephones and to cellphones decline by less than ten percentage points, while the proportion of households in informal and traditional dwellings falls by just over 15 percentage points. However, the declines are steep between deciles seven and ten. The proportion of households without access to landline telephones halves from 81.1 percent in decile seven to 41.0 percent in decile ten, a decrease of over 40 percentage points. Similarly, though less precipitously, lack of access to cellphones declines by over 30 percentage points from 72.8 percent in decile seven to 41.5 percent in decile ten. In terms of type of housing, 28.5 percent of decile seven households reside in informal and traditional housing, compared to 6.9 percent of decile ten households.

Figure 36: Mean Household Characteristics Across School Performance Deciles



Source: SRN 2000, MR 2000 and Census 2001.

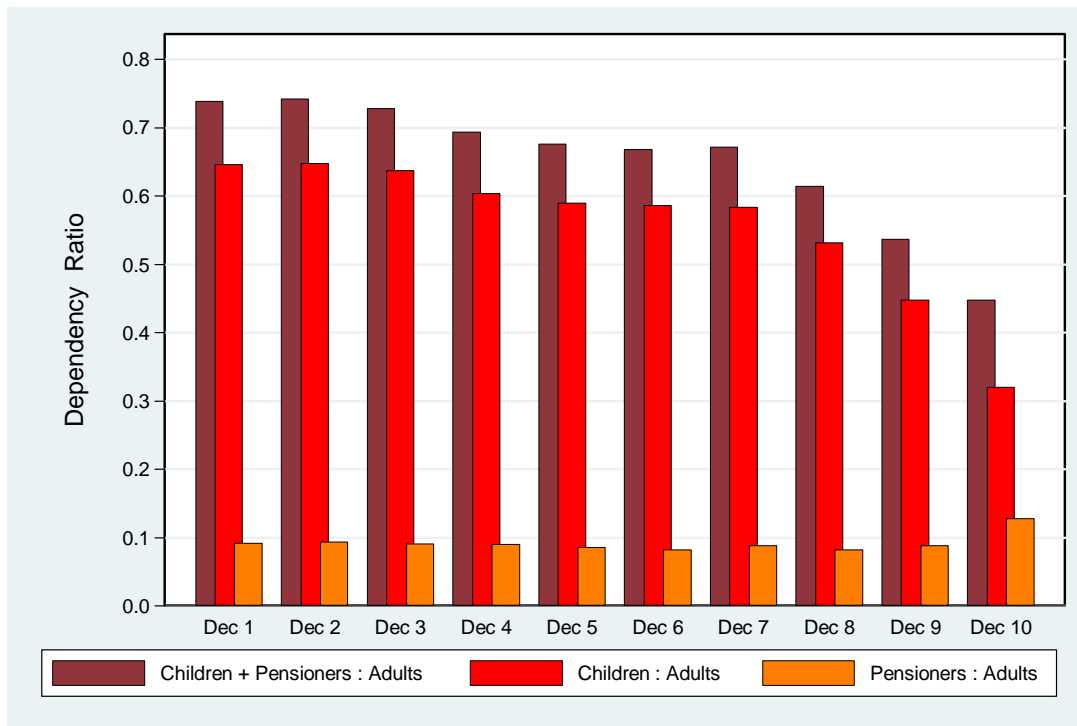
The Census 2001 data also allows for the calculation of dependency ratios, which are measures of the extent to which a certain group is dependent on another group in society. Dependency ratios can be defined in a variety of ways, for example the ratio of non-employed individuals to employed individuals, or the ratio of non-adults to adults. From the data, it is possible to calculate age-defined dependency ratios. Three dependency ratios are presented in Figure 37 below, namely the ratio of children (defined as all individuals under the age of 15 years) to adults, the ratio of ‘pensioners’ (or pension-aged individuals, defined as those aged 65 years and older) and the ratio of non-adults (children and pensioners) to adults, the latter being the sum of the first two dependency ratios.

Once again, the dependency ratios presented are an average for the small areas in which schools in a particular decile are located. In terms of calculation, the population figures for the small areas in which each decile's schools are located are aggregated and the dependency ratios are calculated from that. In other words, the total numbers of children, adults and pensioners in all small areas containing decile one schools, for example, were calculated and used to calculate the average dependency ratios for decile one. In terms of interpretation in this case, the higher the dependency ratio is, the greater the number of children and/or pensioners relative to adults. This means that a greater number of people are dependent on a relatively smaller group.

In South Africa as a whole, there are approximately 59 non-adults for every 100 adults, as indicated by the dependency ratio of 0.59 (own calculations, Statistics South Africa 2003). The majority of 'non-adults' are children, with only eight of the 59 non-adults being of pensionable age. The dependency ratios for the population in small areas with schools with matric results in 2000 are higher, indicating a relatively smaller adult population in these areas. There are more than 65 non-adults per 100 adults in these areas, of which 56 are children and nine pensioners. The main difference in the total South African dependency ratios and the dependency ratios in those small areas containing schools with matric results in 2000 is the higher number of children. This is unsurprising, given that children are more likely to live near schools than they are to live far from schools.

In the lowest four deciles, the child-adult dependency ratio remains above 0.60 and remains above 0.58 up to decile eight. It is only in decile nine and ten that the dependency ratio falls considerably to 0.45 and 0.32 respectively. With only nine individuals of pensionable age per 100 working age adults on average across all school small areas, there is relatively little variation in this dependency ratio. The ratio is above 0.09 in the poorest performing three deciles and between 0.08 and 0.09 in deciles four through nine. The dependency ratio in decile ten is significantly higher than those of the other deciles at 0.13. The combination of these two patterns means that the ratio of non-adults to adults is highest in the lowest deciles (around 0.74 in deciles one and two) and falls gradually to 0.67 in decile seven, after which the decline is steeper. The dependency ratio in decile eight is 0.61, in decile nine it is 0.54 and in decile ten it is 0.45.

Figure 37: Average Dependency Ratios Across School Performance Deciles



Source: SRN 2000, MR 2000 and Census 2001.

The figure therefore seems to indicate that poorer performing schools are located in areas where there is a relatively greater burden on the adult population to support the young and the old. Higher dependency ratios reflect the fact that there are relatively few adults compared to other areas. Thus, in areas around decile one schools, adults account for 57.5 percent of the population, compared to 69.1 percent in areas around decile ten schools. The correlation between average school performance and the dependency ratios can tentatively be linked to insufficient time for adults to engage in their children's learning process, but also to possible greater poverty in areas around more poorly performing schools.

6. CONCLUSION

The education system is critically important to the plans and prospects for economic growth and development in the future, due to its central role in improving the population's levels of human capital. Current skills shortages in the country are considered to be a major constraint hampering the achievement of sustainably higher rates of economic growth. Although no section of the education system is without problems, one of the critical bottlenecks is the relatively low number of passes in the Senior Certificate Examinations that are written at the end of Grade 12. Only those that have passed these examinations and have achieved university exemptions are allowed to enter the university.

This report investigates school-level performance in the 2000 Senior Certificate Examinations. Data from the School Register of Needs Survey of 2000, matric results data for 2000 and the Small Area Layer data from Census 2001 were combined to allow an investigation into various correlates of performance. The distribution of school performances is slightly skewed to the lower end of the distribution, although there is a large proportion of schools that attained very high pass rates. Ten percent of schools obtained pass rates above 96.7 percent. However, performances differ between provinces, with schools in the Western Cape, Northern Cape and Gauteng performing relatively well, while the Eastern Cape and Limpopo provinces performed relatively poorly. These differences are related to the distribution of schools within provinces across the apartheid-era departments of education. Former White schools performed significantly better than former Coloured and Asian schools, which in turn performed significantly better than former African schools, whether these were former homeland schools or former DET schools. Interestingly, schools established since 1994 have similar proportions of schools in the top four performance deciles compared to DET schools, but are also relatively more likely to be located in the worst performing deciles, possibly related to the fact that many new schools would have been established in relatively poor areas, neglected by previous governments.

Generally, the findings of this report have been unsurprising. Variables that relate to school resources and facilities tend to follow similar patterns. In most cases, the variables are relatively stable over deciles one through seven, and it is only in deciles eight through ten that there tend to be significant changes in the variables' values. Platooning and double sessioning, both related to resource constraints, appear to be slightly negatively related to school performance, while independent schools tend to fare better than government schools. In terms of learners per classroom, the main difference between schools in the ten deciles is in the number of shelters used as classrooms and in the number of specialist classrooms available, given the number of learners. The use of shelters is concentrated amongst schools in lower performing deciles, while specialist classrooms are relatively more abundant in better performing schools. However, it is only in the upper-most deciles that learners per total ordinary classroom and learners per classroom in total fall substantially. Similarly, due to the substantially lower number of learners per privately-paid teacher in the top three deciles, the aggregate learners per teacher falls relative to the lower deciles.

Access to various types of equipment and facilities, access to computers, the general construction quality and type of school buildings and schools' access to various services, including water, electricity and telecommunications, all exhibit the expected relationship with school performance. In terms of the relationship between school performance and the socioeconomic characteristics of the local population, better performing schools were more likely to be located in urban areas and less likely to be in rural areas. They were also more likely to be found in areas where higher proportions of the adult population had complete

secondary or complete tertiary education and where relatively more households had access to water, electricity, sanitation, refuse removal and telecommunications. Poorer performing schools were also more likely to be located in areas where a greater proportion of the population resided in informal dwellings and where there were relatively fewer adults compared to children and pensioners (i.e. where the mean dependency ratios were higher).

This report has therefore identified numerous variables that may be included in econometric analysis of school performance in the 2000 Senior Certificate examinations. The patterns observed also seem to indicate that the relationship between a specific variable and performance is likely to vary over the distribution, given the sudden changes in numerous variables at around deciles seven and eight.

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